FLY LIKE A PRO WITH GYROS AND AUTOPILOTS

page 32

MODEL Airplane NEWS

ADVANCED AEROBATICS
Beyond Figure-eights

MORE POWER!
What you need to know about engine heat

Scale rigging made easy
Ziroli shows you how

WE TEST-FLY
Firecat—silent stunt flyer
Tiger 51—fun-fly fighter
Ultra Stick—ultimate aerobat
Laser Arrow—hot delta wing

BIPLANE SETUP SECRETS

APRIL 2002
USA $4.99 CANADA $7.50
04>
7 22627 48120 7

AirAGE PUBLISHING

GO TO www.modelairplanenews.com

MODEL Airplane NEWS

APRIL 2002 VOLUME 130, NUMBER 4

ON THE COVER: Doug Cronkhite put on a spectacular aerobatic show with his Carden Aircraft 40-percent Edge 540 at the Top Dawg scale meet. See John Reid's article on the event on page 28 (photo by author).

FEATURES

CONSTRUCTION

COLUMNS

FLIGHT TESTS

DEPARTMENTS

RC Avionics

Every so often, a technological development comes along that either dramatically improves flight performance or makes our RC models more closely emulate their full-scale brethren. In my opinion, automated, electronic, onboard stabilization systems fulfill both areas of advancement, and they are among the best things that have happened to RC flying since the advent of digital proportional control. With an autopilot or piezo gyro installed, a model immediately becomes easier to fly; it's more controllable, less prone to wind gusts and easier to land. Onboard gyros and autopilots will benefit pilots of every skill level and are made for every model type, from backyard electrics to turbine-powered jets. For the latest in RC technology, see page 32.

This 101-inch-span Ju-87 Stuka dive-bomber was a standout among the warbirds at Top Dawg, covered by contributor John Reid on page 28.

For model airplane engines to run efficiently and deliver the most horsepower, they need to be operated at optimum temperatures. Some of the factors that affect this include oil and nitro content, prop size and cowl type. In this issue, engine expert Dave Gierke advises how to mix your own fuel, set your engine's needle valve and choose the right glow plug. What's the best operating temperature for a 2-stroke engine? Find out on page 76.

Biplane enthusiasts will appreciate senior tech editor Gerry Yarrish's basic biplane advice in his "Thinking Big" column this month. This primer shows you how to determine balance points, measure and set incidences and understand decalage angles, then offers advice on flying and explains how a biplane's increased lift and drag affect its flight characteristics.

Turn to page 110 to see how you can improve your biplane's looks with scale master Nick Ziroli's non-functional rigging and flying wires. Using Nick's simple approach, you'll be able to dress up your bipe in just a few hours.

This month's construction article features a seldom-modeled aircraft: the Siemens Schuckert D-III—arguably Germany's top WW I fighter. This model features a fully sheeted, circular fuselage that's easy to build using a removable center alignment tube. It's ideally suited to scale competition; in fact, author Dave Johnson plans to fly this beauty at Top Gun 2002.

We welcome your comments and suggestions as well as any building techniques or tips you'd like to share. Email us at man@airage.com, or write to us at Air Age Publishing, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

MODEL Airplane NEWS
FOUNDED 1929

EDITORIAL
Editor-in-Chief TOM ATWOOD
Executive Editor DEBRA D. SHARP
Senior Technical Editor GERRY YARRISH
Senior Editor CHRIS CHIANELLI
Associate Editor RICK BELL
Assistant Editors MATT BOYD, JAIME LAGOR
Editorial Assistant MELISSA JONES

PUBLISHING
Group Publishers LOUIS V. DeFRANCESCO JR., YVONNE M. DeFRANCESCO
Associate Publisher SHARON WARNER

COPY
Copy Director LYNNE SEWELL
Senior Copyeditor MOLLY Z. O'BYRNE
Copyeditor COREY WEBER
Associate Copyeditor PAIGE L. HAMILTON

ART / DESIGN
Corporate Art Director BETTY K. NERO
Senior Art Director ALAN J. PALERMO
Promotional Art Director LESLIE COSTA
Associate Art Director JOANNA WINN
Assistant Art Directors VICTORIA HOWELL, COREY W. SMITH
Staff Photographer WALTER SIDAS
Assistant Photographer PETER HALL

ADVERTISING
Director of Advertising SHARON WARNER
Assistant to Director of Advertising/Associate Publisher SIRI A. WHEELER
Lead Account Executive MONA TASSONE
Senior Account Executive KATHRYN GEARHART
Account Executive ANITA LEO
Junior Account Executives CINDI VANDEMARK, SHERRY MORGAN
Advertising Coordinator ANN T. WIEBER

CIRCULATION
Circulation Director MARC LIU
Circulation Manager CARMINA M. McGOVERN

MARKETING
Media Marketing Manager VANESSA LaFERRIERE

OPERATIONS
Director of Operations DAVID BOWERS
Senior Digital Production Coordinator CHRISTINE BACHMANN-CORBIN
Digital Production Coordinator CHRISTINA MASCHKE-MILEO
Production Associate TOMLINSON S. WHEELER
Production Assistant BOBBI-JO BALDWICK

INTERNET
Director, Electronic Communications GARY KOLESAR
Web Developers LEO FICKS, HOLLY HANSEN
Database Coordinator DAN WELSH
Web Programmer JAIME TORRES

CORPORATE
Chairman of the Board ALDO DeFRANCESCO
President and CEO LOUIS V. DeFRANCESCO JR.
Secretary and Executive Vice President YVONNE M. DeFRANCESCO
Treasurer and Chief Financial Officer CAROL SHEPHERD

CONTRIBUTORS
Bob Aberle, Bernard Cawley, Roy L. Clough Jr., Roy Day, Don Edberg, Dave Garwood, Dave Gierke, Henry Haffke, Tom Hunt, Michael Lachowski, Andy Lennon, George Leu, Jim Newman, Vic Olivett, Jim Onorato, Dave Patrick, Randy Randolph, Jef Raskin, Faye Stilley, John Tanzer, Craig Trachten, Rich Uravitch, Bob Van Tassel, Dan Wolanski, Nick Ziroli.

Member Audit Bureau of Circulations
AirAGE PUBLISHING
MPA Magazine Publishers of America

100 East Ridge, Ridgefield, CT 06877-4606 USA
www.modelairplanenews.com
PRINTED IN THE USA

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

A TIN-GOOSE CHASE

I have a challenge for you. I run a website, www.FordTriMotor.org, and we get frequent inquiries from people who want to acquire Ford Tri-Motor models of all types (or the plans for them). Is there such a thing as an RC kit or set of plans for the old "Tin Goose"? [email]

SCOTT LOWE

We don't know of any kits out there, but we do offer a set of plans for the Ford Tri-Motor in the Model Airplane News *plans library. Designed by Dennis Tapsfield and published in our December 1977 issue, the plan is numbered FSP12772. The Ford Tri-Motor A.T.5-Tin Goose is a semi-scale model that can be powered either by three electric motors or three glow engines. It is straightforward balsa and ply construction, has a 60-inch span and is 39.5 inches long. The 4-channel model is intended for three .049 ½A engines or 05-size motors. The one-sheet plan sells for $19.95. To order it, visit the* Model Airplane News *RCStore website at www.rcstore.com and click the plans button.*

GY

PUP POWER

I have a ¼-scale Sopwith Pup, and I power it with an O.S. .91 engine. The model weighs 15 pounds; will a .91 4-stroke engine be powerful enough to fly my 77-inch-span model at this weight? [email]

WALTER BURANEN

Walter, "How much power is enough?" is a relative question; several points need to be clarified before I can answer it. Running some preliminary numbers will give us a rough "go/no-go" decision. At 15 pounds (240 ounces), your model with its 1,985 square inches of wing area (13.78 square feet) will have roughly a 17.4-ounces-per-square-foot wing loading. This is a very good number, as I use 23 ounces per square foot (or 100 square inches per pound) as my preferred wing-loading goal. The O.S. .91 Surpass II 4-stroke engine is rated at roughly 1.6hp at 11,000rpm. This much power gives your Pup a 9.375:1 power loading (weight/hp)—again, a good value, since I try never to exceed 12 pounds per horsepower. All things considered, and compared with other WW I biplanes, your model should have adequate power to fly safely and realistically. A .91 is the lowest engine size recommended by Balsa USA for its ¼-scale Sopwith Pup, so you will have to fly your model in a scale manner; don't treat it like an aerobatic biplane that would have a power loading in the 6- or 7-to-1 range. Good luck.

GY

SPINNER FOR A TEXAN

Howdy. I was having a problem finding the correct spinner for my Top Flite T-6 Texan, but then I saw a picture of the one I want in your September 2001 issue. The model it was on was painted in the Blue Angels' paint

scheme with a yellow spinner. Do you know who sells these T-6 Texan-style spinners? It's the one that's used on the Top Flite Stinson Reliant. Thanks. [email]

DAVID

Hey David, here's an easy answer to your question: contact Tru-Turn. It offers this spinner in sizes from 2¼ to 4 inches and provides adapter kits that mate its aluminum spinners to any popular engine. You can reach the folks at Tru-Turn by calling (713) 943-1867; they'll set you up. The full address is Tru-Turn/ROMCO Mfg., P.O. Box 836, South Houston, TX 77587; www.tru-turn.com.

GY

FINDING A FORTRESS

I'm trying to locate a set of scale plans so I can scratch-build a B-17 Flying Fortress bomber such as the one shown on the cover of the November 2001 issue of *Model Airplane News*. I have searched everywhere and cannot find a source. Any suggestions?

JON

Jon, a very popular B-17 plan set is available from Don Smith Plans. Don's catalog costs $3; you can reach him at 620 Hastings St., Boca Raton, FL 33487; (561) 989-9113; www.donsmithplans.com. The plan produces a model that has a 138-inch wingspan and is 98.4 inches long. The eight-sheet plan set costs $62. Don also offers fiberglass engine cowls and a plastic parts package including cockpit section, nose bubble, gun turrets, windows, gun placements and superchargers.

If you would like something a bit smaller (75-inch span), check the electric-powered B-17 plan set available from Pat's Custom Models, 10313 Snow Heights Blvd. NE, Albuquerque, NM 87112-3054; (505) 296-4511; PatsCustomModels@aol.com; www.thuntek.net/pcmodels. Good luck on your bombing mission!

GY

PILOTS ON PARADE

The "Pilot Patrol" feature in the February 2002 issue really caught my attention because when I build a model, I make it a priority to select an appropriate pilot figure. Your article was fantastic; you showed excellent sources and websites offering products I never even knew existed. This information was long overdue—thank you for publishing it.

One note: an omitted source that is well known to readers of British modeling magazines is "Pete's Pilots," whose products are seen in the best UK models. Top Flite also makes a great pilot that, unfortunately, missed the roll call. Thanks again for a great magazine! [email]

DARRYL CARPENTER

Darryl, thanks for your encouraging comments; we had a lot of fun putting together the pilot-figure guide. You are correct; we did not mention that the pilot figures offered by Nelson Hobby Specialties are actually manufactured by Pete's Pilots in the UK. As far as the Top Flite pilots are concerned, when we contacted Great Planes, we learned that these little guys have been discontinued.

GY

AIR SCOOP

by Chris Chianelli and the staff of Model Airplane News

NEW PRODUCTS OR PEOPLE behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will at times cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

HANGAR 9

GRADUATION CAP

Many aerobatic models are designed with all-out performance in mind, which means that that those modelers who are trying to master aerobatics have to dive in at the deep end. Not so with the new Sport CAP ARF from Hangar 9; it blends the stability and ease of assembly of an ARF sport plane with a CAP's legendary aerobatic performance. The result is a plane that's perfect for the pilot who has mastered basic flight techniques and is ready to step up to aerobatics. The CAP accepts most .40 to .48 2-strokes or .56 to .72 4-strokes and comes 90-percent prebuilt out of balsa and ply. The model comes covered in UltraCote in the colorful Breitling trim scheme, and all the necessary hardware is included. It's priced to sell at $199.99.

Hangar 9, distributed by Horizon Hobby Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; www.horizonhobby.com.

We know it's difficult to resist those big, beautiful models that look so scale when they're soaring across the sky. It's even more difficult when most of the work has already been

GIANTSCALEPLANES.COM

Christen Eagle and Corsair

done for you. That's why we're pretty sure you'll find the new Corsair and Christen Eagle from Giantscaleplanes.com fairly irresistible. Each model comes with a completely built-up fiberglass fuselage and should be powered by a .90 to 1.08 2-stroke or 1.20 4-stroke engine. The Corsair has a 75.5-inch wingspan, and both the top and bottom wing of the Christen Eagle span 61 inches. Each plane costs $399.99.

Giantscaleplanes.com, 201 S. 3rd St. & Rt. 309 N., Coopersburg, PA 18036; (610) 282-4811; www.giantscaleplanes.com.

OK EZ MODELS

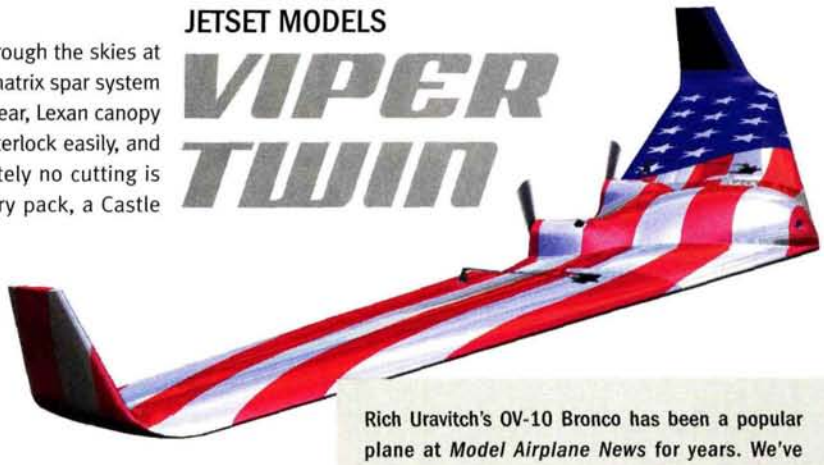
Voodoo

Nothing impresses your flying buddies like a Reno Racer, and the new Voodoo from OK Models will definitely turn them pea-green with envy. The Voodoo has the same airframe and mechanical design as the already popular Dago Red, with a distinct finish that's an accurate reproduction of its full-size counterpart. The Voodoo also comes with Supra mechanical retracts, and it only requires application of decals to complete its scale appearance. This almost-ready-to-fly model uses simple and straightforward construction techniques and can be completed in just a few days. The Voodoo has a 54.7-inch wingspan, weighs nearly 6 pounds and requires either a .46 to .50 2-stroke or .70 to .80 4-stroke engine. It sells for $360.

OK EZ Models; distributed by Model Rectifier Corp., 80 Newfield Ave., P.O. Box 6312, Edison, NJ 08818; (732) 225-2100; www.modelrec.com.

JETSET MODELS

VIPER TWIN



This twin, Speed 400-powered Viper ARF will have you soaring through the skies at speeds of up to 50mph in no time flat. It features a triple-carbon-matrix spar system to minimize wing flex and strengthen its overall structure, and a clear, Lexan canopy provides a sleek airflow to reduce overall drag. All of the parts interlock easily, and the servo bays come already molded into the wing, so absolutely no cutting is required. The Viper comes with an 8-cell, 1300mAh SCR battery pack, a Castle Creations Pixie 20A speed control and all of the necessary hardware. This 55-inch-wingspan model makes the perfect elevon trainer, thanks to great low-speed characteristics and crash-resistant Arcel foam wings. The Viper sells for $149.99.

JetSet Models, 117 2nd St., Lakewood, NJ 08701; (732) 539-8002; fax (732) 363-6874; hobbymaster@aol.com; www.jetsetairplanes.com.

ESPRIT MODEL

Fiberglass Floats

Looking for the perfect pair of floats to get that seaplane on the water this spring? Check out this new line of 25-, 40-, 60- and 90-size floats from Esprit Model. With these gelcoated, fiberglass floats, you can fly off water, snow, or even wet grass, and they can easily be modified for 3-wheel and tail-dragger models. The floats are available in two models: the 28-inch-long "A" models weigh 8 ounces and are designed to accommodate 3- to 4.5-pound aircraft; the 32-inch-long "B" models weigh 10 ounces and fit 5- to 8.5-pound airplanes. Both sets come with all of the necessary hardware and complete instruction manuals. Prices: $59 (model A); $69 (model B).

Esprit Model, 657 Worcester St., #902, Southbridge, MA 01550; (508) 764-4990; prop.rc@verizon.net.; www.espritmodel.com.

SCALETECH

OV-10 BRONCO

Rich Uravitch's OV-10 Bronco has been a popular plane at *Model Airplane News* for years. We've reviewed kit versions and have noted its first-rate design quality and flight characteristics. Now those virtues can be yours without having to scratch-build this 52-inch beauty. ScaleTech includes all required hardware and a fully covered airframe. The canopy frame and cowls are already painted to match the covering. Also included are decals and photo-illustrated instructions. Just add your radio system and two .25 to .32 2-stroke engines. It sells for $279.95.

ScaleTech; distributed exclusively by Hobby Hangar, 7715 Industrial Way, Melbourne, FL 32904; (321) 727-8227; hobbyhangar@aol.com; www.hobbyhangar.com.

PLANES PLUS INC.

EXTRA 330S

Built in response to demands for a smaller version of the Fiberclassics 40-percent-scale TOC Contest Pro, this 33-percent-scale Extra 330S is extremely maneuverable, thanks to its light weight and large control surfaces. This IMAA-legal Extra weighs 23 pounds, has a 102-inch wingspan and is powered by a 100cc engine. Fiberclassics also offers a building service for any of its aircraft. Prices for the model start at $1,895.

Planes Plus Inc., 10233 Clow Creek Rd., Plainfield, IL 60455; (630) 904-9983; fax (630) 904-5077; www.fiberclassics.com.

FIBERTECH AVIATION

Edge 540

Dozens of 100cc engines on the market are looking for homes in giant-scale planes, and Fibertech Aviation designed its new, 36-percent-scale Edge 540 specifically with these engines in mind. This 104-inch-wingspan model features a white, gelcoated, epoxy-glass fuselage, a fiberglass cowl and wheel pants, balsa-sheeted foam wings, a clear canopy, an aluminum tube wing spar and formed landing gear. All of the control surfaces come already cut out and capped, and the wing and stab tube sleeves come already installed. All of the high-stress areas are reinforced with carbon fiber for added strength. The Edge 540 weighs between 26 and 28 pounds and sells for $1,199.

Fibertech Aviation, 2185 Outrigger Ln., Naples, FL 34104; (941) 269-2555; sales@fibertechaviation.com; www.fibertechaviation.com.

MM GLIDERTECH

WEDGIE

There's no denying the popularity of flying wings, and MM GliderTech answers this growing demand with the introduction of the Wedgie. Designed to use any standard RC equipment, the Speed 400-powered Wedgie is capable of amazing high-speed aerobatics, axial rolls and full outside maneuvers. The kit includes CAD blueprints, white foam-core wings, precut tip fins and a motor mount. This 34-inch-wingspan model can reach speeds of up to 60mph in level flight, and it sells for $51.95 (plus $6 S&H).

MM GliderTech, P.O. Box 39098, Downey, CA 90239; phone/fax (562) 927-2583; mmglidrt@keyway.net; www.mmglidertech.com.

MODEL TECH

GILES G-202 ARF

Designed with the experienced modeler in mind, this 60-size aerobat is impressive both in the air and on the ground. The 61⅜-inch-wingspan model comes with detailed instructions and an array of hardware, including an adjustable firewall and engine mount that allow it to accommodate a variety of engine and radio combinations. Model Tech suggests that the Giles be powered with a .91 to 1.08 2-stroke engine, but it can also easily handle a 1.20 4-stroke for you freestyle enthusiasts. The G-202 comes completely built up of balsa and ply and finished in iron-on covering. The kit also features aluminum landing gear, a molded fiberglass cowl and wheel pants painted in fuelproof paint to match the rest of the aircraft. The Giles G-202 sells for $229.99.

Model Tech; distributed by Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92708; (714) 963-0133; fax (714) 962-6452; www.globalhobby.com.

GLOBAL HOBBY DISTRIBUTORS

NOW THE EXCLUSIVE DISTRIBUTOR OF CLANCY AVIATION

Andy Clancy, founder of Clancy Aviation (left), shakes on it with Matt Fales, president of Global Hobby.

Global Hobby continues to improve on its ever-expanding line of high-quality aircraft by forging a new partnership with Clancy Aviation. As its exclusive distributor, Global Hobby now carries the complete line of Clancy Aviation products. The two companies will collaborate to continue manufacturing Clancy Aviation's unique and innovative aircraft, including the popular Bee series.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92708; (714) 963-0133; fax (714) 962-6452; www.globalhobby.com.

BOB FIORENZE

Twin Cockpit

Anyone who has ever built a truly scale fighter knows that a great deal of the work must be put into the cockpit. A single-seat plane alone can take weeks of intricate labor to get just right—never mind a two-seater! Bob Fiorenze has come to the rescue of scale modelers everywhere with this new, lightweight twin cockpit. In addition to instrument and side panels, this extremely detailed cockpit features a tub, seats, seat cushions, throttles and joysticks. It's constructed of styrene and comes complete with precut decals, as well as written and photo-illustrated instructions. It costs $100.

Bob Fiorenze, 401 Westchester Dr., Altamonte Springs, FL 32701; (407) 673-9080; www.rcaviation.com/fiorenze.

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.

CANOPY CLEANUP

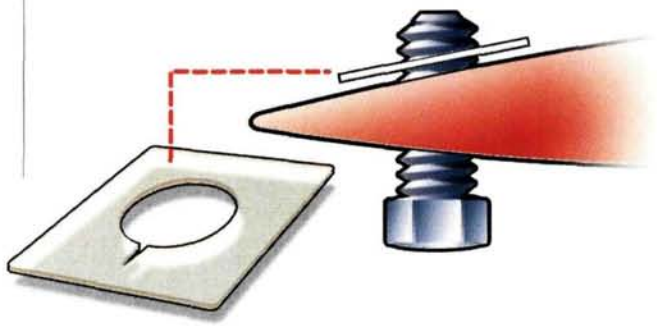
Have you ever removed the masking from the canopy only to find paint over-spray? Don't toss out an otherwise good canopy; instead, look for paste-type aluminum polish in your local hardware or auto-parts store. The very mild abrasive paste gently removes any over-spray after a couple of applications. The paste also removes fogging caused by CA glues.

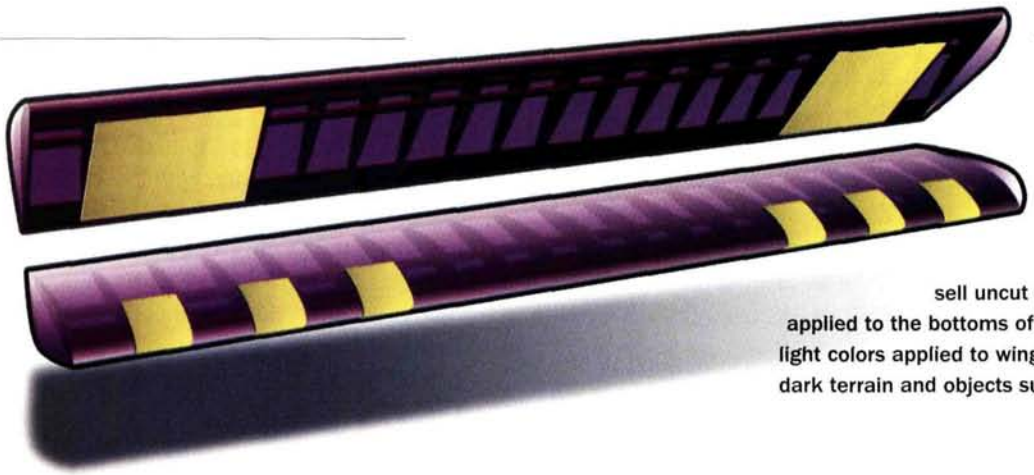
Thomas Botkin, Winter Haven, FL

SIMPLE BOLT RETAINERS

Here's an easy way to make a retainer that allows the bolts to remain with the wing for quick assembly at the field. Cut a CA hinge in half and punch a hole that's slightly smaller than the bolt in the hinge. Then cut a slit in the hinge to allow the bolt to thread through the hinge. When you remove the wing, the bolts will remain with the wing.

Richard Vidug, Erin, Ontario, Canada





INEXPENSIVE ORIENTATION MARKINGS

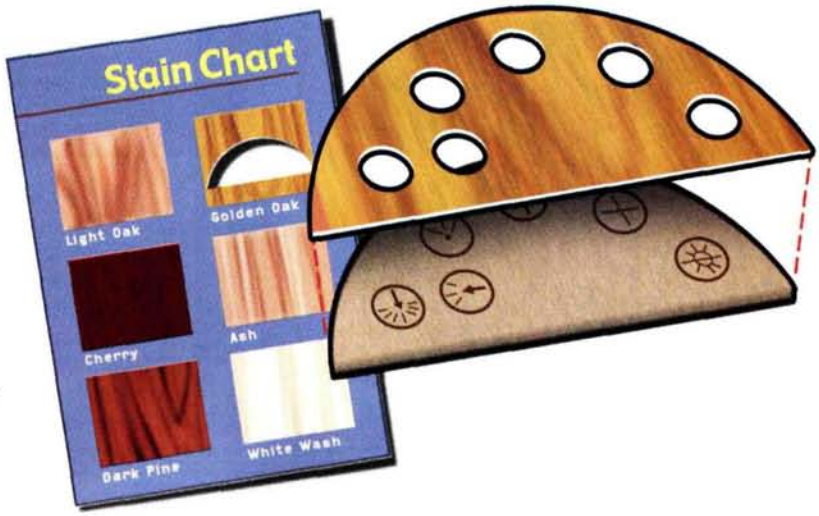
Here's a simple, easy tip to aid orientation while flying. Many sign shops that cut vinyl letters usually sell uncut vinyl sheet by the foot. Contrasting colors applied to the bottoms of wings are visible at great distances, and light colors applied to wings' leading edges aid visibility against dark terrain and objects such as trees during landing approaches.

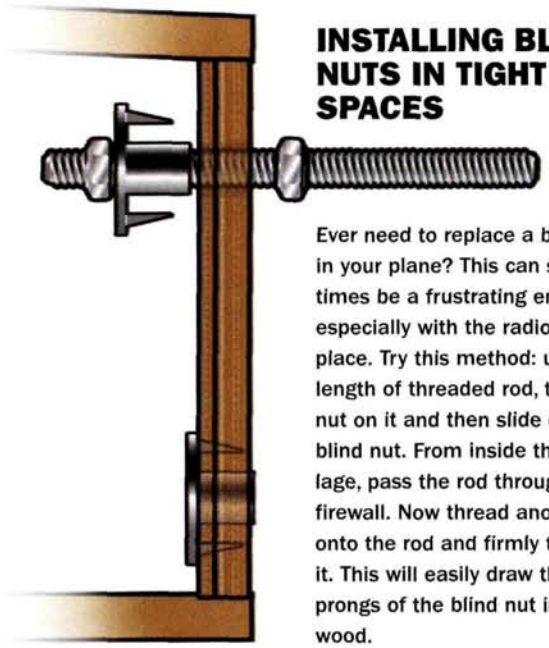
Gary Crooks, Mesquite, NV

WOOD-GRAIN INSTRUMENT PANELS

Here's a quick and easy technique to make a finished wood-grain instrument panel. Go to your local Home Depot and pick up some paint and stain pamphlets. They're printed on heavy, glossy paper in many different colors, and best of all—they're free. After you've made your instrument-panel backing and laid out the instruments as desired, choose an appropriate size and color sample for the instrument panel face. Cut it to size, punch the holes for the instrument faces and then glue the sample onto the backing. When you've finished, you'll have made a great-looking instrument panel with little effort.

Harry Braunlich, Victor, NY





INSTALLING BLIND NUTS IN TIGHT SPACES

Ever need to replace a blind nut in your plane? This can sometimes be a frustrating endeavor, especially with the radio gear in place. Try this method: using a length of threaded rod, thread a nut on it and then slide on a blind nut. From inside the fuselage, pass the rod through the firewall. Now thread another nut onto the rod and firmly tighten it. This will easily draw the prongs of the blind nut into the wood.

Richard Rader, Bridgeport, WV

CLOG-FREE CA GLUING TIPS

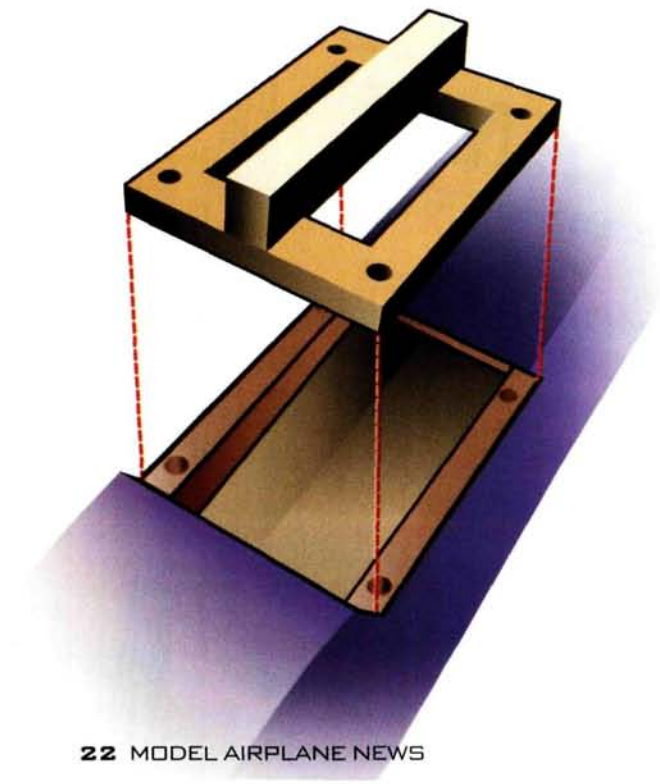
Glue tips on CA bottles have a tendency to clog. You can avoid the problem by keeping a few extra gluing tips in a 35mm plastic film canister filled with acetone. Soaking the tip in acetone prevents the CA from clogging and keeps it ready for use. Be sure to keep the canister tightly sealed to avoid any hazardous fumes.

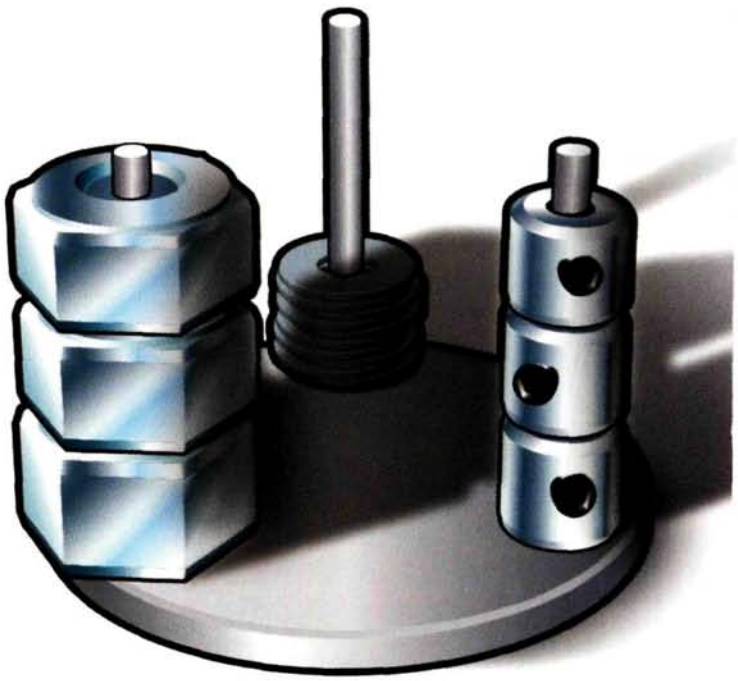
Pat Percival, Independence, OH

CONVENIENT AIRCRAFT CARRIER

It isn't always easy to carry a large-scale fuselage. If the fuselage is long, carrying it vertically is difficult at best. An easy solution is to make a carrying handle out of a piece of ¼-inch plywood that matches the wing opening in the fuselage. Drill matching holes in the plywood for the wing-mounting bolts, and attach a handle made of pine. Carrying a fuselage with a handle is a lot safer, as the center of gravity is under the handle for a more balanced feel.

Charles Kuhl, Commack, NY





FREE STORAGE

Here's a neat use for those plastic "tables" you find in pizza boxes. Instead of using small cups or containers to store small parts such as washers, nuts, wheel collars, etc., use the tables to hold and keep track of those small parts. You can screw them to your workbench or to a piece of wood for portability. They can be screwed down tightly or left slightly loose to rotate.

George Negraiff, Goderich, Ontario, Canada

PILOT PROJECTS

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable but please do not send digital printouts. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

David Ettinger, Southlake, TX
GREAT PLANES PATRIOT

David, who has been flying for 25 years, sent us this photo. His 6-pound GP Patriot is powered by an O.S. .46 FX and is equipped with Hobbico retracts. This great-looking model is covered with Top Flite MonoKote. A Hitec Flash 5X with 6 servos guides it through thrilling aerobatics. David says that this is his first model with retractable landing gear and that flying with the gear up is worth the extra building effort.

Jack Lake, Enderby, British Columbia, Canada
CURTISS R3C2

Jack writes that it took him 3 years to build this ⅓-scale Curtiss R3C2 from a Don Smith plan. The 43-pound, 88-inch-span Schneider Cup racer is built up of balsa and lite-ply and features 21st Century fabric on the wing, as well as a glassed and painted fuselage and styrofoam floats. Jack says the Brison 5.8-powered model flies very well.

Mark Nagley, Tacoma, WA
SIG SOMETHIN' EXTRA

This Sig Somethin' Extra comes to us from Mark Nagley, who is a member of the Mount Rainier Radio Control Society. A SuperTigre .51 swinging a 10x7 APC prop provides the Extra with nearly unlimited vertical performance. Mark uses a Futaba radio with 5 servos to control the MonoKote-covered model. To dress it up, Mark added graphics he made out of magazine advertisements.

Tim Smith, Lewisburg, TN
HOBBY LOBBY TELEMASTER 40

Tim couldn't have picked a better plane for his first RC trainer. An O.S. .40 LA turning a 10x6 prop powers the 73-inch-span plane. Tim designed the Rebel paint scheme for the 3-channel model and plans to add ailerons. He highly recommends the Telemaster for anybody who's looking for a good Sunday flyer.

William Sterka, Sarasota, FL
BRITTEN-NORMAN TRISLANDER

Beverly Sterka holds her husband Bill's mostly scratch-built Trislander. The 79-inch-span model started life as a Cermark Islander twin that Bill converted into the 3-engine configuration. Bill reports that the model looks awesome in flight, and the sound from its three engines is incredible.

Carlos Fondren, Shelter Cove, CA
KIT-BASHED SIG LT-40

Carlos likes the flying qualities of the Sig Kadet LT-40 so much that he kit-bashed the high-wing trainer into a low-wing sport flyer. He changed the airfoil, moved the wing to the bottom of the fuselage and built up the canopy where the wing used to be. The modifications worked so well that he went one step further and designed a larger version that can accommodate a Zenoah G23. Carlos ended up with a 90-inch-span model that weighs 13½ pounds and flies as well as its smaller brother. He says that with a 24-ounce tank, the model can stay in the air for a very long time.

Jerry Leake, Scottsdale, AZ
PICA WACO

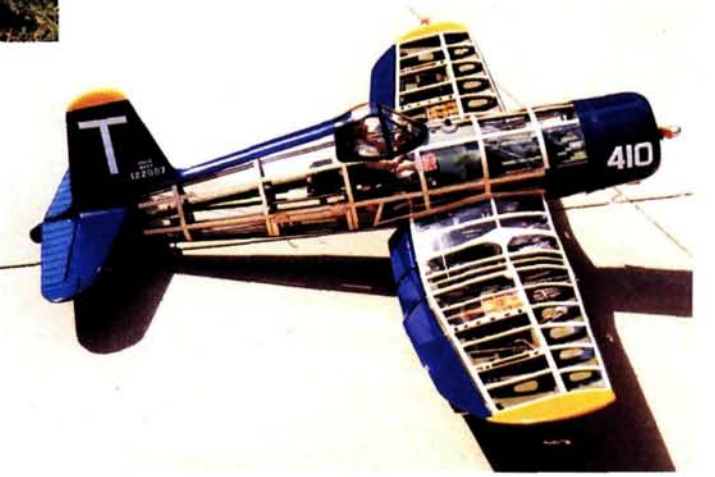
*Jerry's WACO suffered some minor damage last year while landing. To refin*ish the classic bipe, He used 21st Century fabric and Rust-Oleum paint. The paint scheme is from a full-scale WACO he saw at the Sun 'N' Fun event at Lakeland, FL. A 15-year-old O.S. 1.20 4-stroke with a 15x6 Master Airscrew prop powers the bipe very realistically. The model weighs about 12 pounds, and Jerry has now added flying wires and a dummy radial engine. A neat feature is the JR gyro he uses on the rudder; he reports that it really helps to keep takeoffs and landings straight.

Serge Besner, Edmonton, Alberta, Canada
LANIER SHRIKE

Built and covered in Ultracote by Serge's friend Ken Cameron, this little 35-inch-span delta-wing model is powered by an RJL Conquest .15. Serge is now installing the Hitec radio system and is eager to make that first flight.

Tony Prieboy, Lecanto, FL
ROYAL P-6E CURTISS HAWK

Tony tells us that he bought this Royal kit in 1990 for a friend who started to build it but was unable to complete it. Eleven years later, Tony completed the classic Hawk, which he powers with a Saito .91 GK and guides with a JR radio. No Golden Age fighter would be caught dead covered with plastic film, so Tony used 21st Century fabric and Goldberg Ultra Paint for the trim colors. Like a fine wine, some things just get better with age.



Robert Slaton, Independence, MO
TOP FLITE CORSAIR

When Robert built his Top Flite Corsair, he "clearly" had something different in mind. And the results are truly remarkable. The wings and fuselage are covered in clear MonoKote to show the airframe construction, which has been changed to closely match the full-scale aircraft's. The model's features include a detailed "Pappy" Boyington pilot figure, handmade machine guns with ammunition belts and detailed fuel tanks. The model is powered by a Magnum .91 RFS, and it has Robart 190-degree retractable landing gear. For his amazing workmanship, Robert earned "Pilots' Choice" at the Kansas City Radio Control Competition.

TOP DAWG Sca

SCALE FLY-IN

by John Reid

The class of the field was Chuck Brooks' ¼-scale de Havilland Tiger Moth. Chuck's 88-inch bipe earned him the Best Scale Flight, Pilots' Choice and People's Choice awards. Its fully detailed cockpit, realistic rigging and beautiful paint job were irresistible.

The sun was just cresting above the hills to the east of Johnson Field in Palomar, CA, as the Palomar RC Flyers opened the field for the Top Dawg 2001 scale fly-in. Held on Labor Day weekend, by 6 a.m. on Saturday, the parking lot was already crowded with cars. This was the first event that I ever attended where the spectators arrived before the participants! During the next two days, approximately 1,000 people were treated to a first-class scale competition that included a swap meet and a pancake breakfast.

Sixty-four planes and 51 participants from all over California, Arizona and Mexico attended this premier two-day event. This scale fly-in featured four classes of competition, but the relaxed atmosphere made it seem more like a casual fun-fly. After the pilots' meeting, the planes took to the air. One after another, the scale planes queued up: biplanes, WW I and II combat planes, modern-day fighter planes and a wide assortment of civilian aircraft. All participants flew as often as possible so as to score points with the judges, spectators and other pilots, and for a chance to take home one of the many merchandise and cash prizes.

outhern California style

Left: this 57-inch-wingspan Liberty Sport was built and flown by Kenny Kear of Mesa, AZ, and is a nearly exact replica of a full-size plane owned by his father. Above: Curtis Kitteringham was in charge of the flightline at Top Dawg 2001, so he didn't have free time to fly. Though perfectly capable of flight, his beautiful B-25 was instead entered in static competition. It features working gear and bomb-bay doors.

A highlight was Doug Cronkhite's aerobatic demonstration with his beautiful 40-percent Edge 540, powered by a Desert Aircraft twin.

This 101-inch-span Ju-87 Stuka dive-bomber was a standout among the warbirds at Top Dawg. Don Guliher built this superbly detailed model from a Nick Ziroli plan.

This 87-inch-wingspan DC-3, built and flown by Harold Ellis of San Clemente, CA, features working retracts and flaps.

THE PLANES

Some exceptional biplanes took to the sky. Among them was a 99.9-percent-scale Lloyd Liberty Sport biplane scratch-built by Kenny Kear of Mesa, AZ, patterned after a full-size plane once owned by his father. Ken Perkins of Lakeside, AZ, flew a 70-inch Sopwith Camel, and he also displayed a 60-inch Sparrowhawk biplane at the static exhibit. Others included an S-1 Pitts and an Ultimate biplane that were flown by Manuel Suarez Jr. of Enseñada, Mexico.

Planes from WW II were also well represented. The field included a Zero, two P-47s, a Supermarine Spitfire, a PT-19, two P-51s (a D and a K), an F4U Corsair, a Curtis P-40, a P-39 Airacobra and an outstanding 101-inch-span Ju-87 Stuka dive-bomber. Three 1/12-scale Zeros flew superb formation—staying in formation even during takeoff and landing.

The ducted-fan planes' aerobatics and low-altitude flybys were big crowd pleasers. Mark Padilla put his 45-inch-span A-4 Skyhawk through many scale maneuvers and low flybys during his flight. Tony Kameen flew a very nice F-15E Strike Eagle and also entered his nicely detailed F-4 Phantom in the static display.

By far, the scale aerobatic planes elicited the most "Ohhhs" and "Ahhhs" from the crowd. Doug Cronkhite of San Diego, CA, flew a 40-percent Edge 540 powered by a Desert Aircraft 150cc twin. He performed maneuvers that I had not believed possible; his spectacular tumbling feats seemed effortless.

RESULTS

After two terrific days of flying and flaunting the intricate details of scale planes, winners had to be selected. This was, after all, a competition, although you wouldn't have been able to tell by the relaxed atmosphere; the fliers and

This 80-inch-span C-119 Boxcar was a real crowd-pleaser. During a flyby, Jimmy Markham of Helmet, CA, activated the functional cargo doors to release four parachutes. Nice job on an unusual subject!

spectators wore smiles all weekend. When the votes were tallied, Chuck Brooks of Tucson, AZ, came out on top. He had impressed everyone with his ¼-scale, 88-inch-span de Havilland Tiger Moth that featured full cockpit detail, realistic rigging and bright yellow paint. Judged by an anonymous panel (a subjective consensus), Chuck won Best Scale Flight. He also won the Pilots' Choice award (selected by the pilots), and the People's Choice Award (voted on by all spectators). Chuck took home $250, three plaques, a Dynaflite giant scale Piper Cub kit and a Sirius Charger.

The award that pilots didn't want to receive was the one for the "Most Spectacular Crash." Unfortunately, Dennis O'Conner captured it with a dramatic crash on a flyby; a switch cover came off his F6-F Hellcat during a bombing run. The plane was totaled, but as a consolation for the carnage, Dennis took home a Hitec radio and a plaque. Each participating pilot received a Top Dawg T-shirt and a free lunch on Saturday. Prizes weren't limited to the participants; in a spectator raffle, the Palomar RC Flyers gave away a fully equipped trainer. The Top Dawg Event had 41 sponsors who supplied prizes worth almost $4,000.

If you're looking for a scale event to compete in for the first time, or if you just want to relax, watch good flying and admire fine scale planes, the 2002 Top Dawg scale fly in will be the place to be. For more information, see the Palomar RC Flyers' website at www.palomarflyers.com.

Above: this A4 Skyhawk performed many scale flight maneuvers and several thrilling low-altitude flybys with builder Mark Padilla at the sticks. Left: Manuel Suarez Jr. came from Enseñada, Mexico to fly his 53-inch Ultimate aerobatic biplane.

The pilot of this once lovely F6F-5 Hellcat, Dennis O'Conner, was the unfortunate recipient of the "Most Spectacular Crash" award. The Hellcat will be sorely missed, but with Dennis' obvious building skills, he'll be back in competition in no time.

Become a Better Pilot with Gy

by Rick Bell

From the beginning of free-flight modeling, pilots have tried to devise ways to improve a model's flight stability. From rudimentary trim tabs to Rube Goldberg-like weight-and-pendulum systems that activated basic control surfaces, the equipment modelers developed to right their models' flight paths eventually led to the birth of radio control as we now know it. But the development of stabilizing devices continued, and onboard electronic accessories for the RC models of today have become very sophisticated indeed. From autopilot systems that can make a trainer almost crash proof to gyros that smooth out control-surface movement, these units help both novice and advanced pilots fly better. For many modelers, gyros and autopilots are tools that enhance their model's performance. Let's take a closer look.

Gyros

Futaba GYA-350 & GYA-351

These gyros were specifically designed for airplane use. Both feature Futaba's SMM (Silicon Micro Machine) technology, which means that the micro machining is done right on the silicon chip. Both gyros have dual rates and an active angular velocity control system (AVCS); that feature is the equivalent of heading-hold, only it's more accurate and less susceptible to vibration. The GYA-350 is for a single servo on a single axis, and the GYA-351 is for dual servos on a single axis. **Prices: GYA-350 $149.99; GYA-351 $169.99.**

Hobbico Airplane Piezo Gyro & Multi-Purpose Piezo Gyro

The Hobbico Airplane Piezo Gyro is especially designed for fixed-wing aircraft. It has two servo-output ports, so it can be used with dual-aileron or elevator-control setups. A built-in circuit cancels the gyro's sensitivity when the control stick is moved 50 percent of full deflection. The Hobbico Multi-Purpose Piezo Gyro is smaller and can fit into tighter spots; it supports a single servo on a single axis. **Prices: Airplane Piezo Gyro $139.99; Multi-Purpose Piezo Gyro $89.99.**

INSIDE PIEZO GYROS

Piezo gyros have been used in RC helicopters for several years and are now finding their way into airplanes. Piezos offer many advantages over mechanical gyros, but just what is a piezo gyro? First, a brief description of a mechanical gyro is in order. Mechanical gyros use a small motor to spin flywheels that are attached at each end of the motor shaft. This suspended assembly moves about a horizontal axis positioned at a right angle to the motor shaft. Centering springs allow the flywheel assembly to tilt until the spring tension halts it. A sensor measures the amount of tilt and sends a signal to the servos to counteract unwanted movement.

Piezo gyros are based on a vibration angular velocity sensor. This metal bar sensor has a triangular cross-section with a piezoelectric (piezo crystal) transducer on each face of the sensor that can sense bar vibrations. When the piezo gyro is turned on, a current causes the bar and piezo crystals to vibrate. When the gyro is still, the signals (vibrations) between two of the sensors are equal. If the gyro is rotated about its axes, the sensors detect different vibration intensities, and these differences are picked up as unequal signals that can be measured as rotational speed of the sensor. And, as with the mechanical gyro, the sensor sends a signal to the servo to counteract the unwanted movement.

What a difference a few years make! The mechanical gyro (right) has a motor, flywheels and springs; all are prone to wear and breakage. The piezo gyro (left) has no moving parts to wear out, and it is more responsive. The rectangular silver box contains the heart of the gyro—the piezoelectric crystals.

So what are the advantages of a piezo gyro over a mechanical gyro? Due to its size, it is much easier to install. Most piezo gyros are small cubes that plug in between the receiver and servo; gone is the sensor, amplifier and switch assembly. Piezos are also more motion-sensitive and offer greater performance, and since a motor is no longer needed to spin the flywheel, they also have much less current drain. Because piezos have no moving parts to wear out, they will last a lot longer and are also more crash resistant than mechanical gyros. As you can see, piezo gyros are the way to go.

s and Autopilots

USES FOR GYROS

There are two types of piezo gyros: heading-hold and non-heading-hold. Most gyros for fixed-wing use are of the non-heading-hold type, while heading-hold is very common for helicopter applications. Gyros come in different sizes, and some have the ability to remotely adjust the gain (sensitivity) from the transmitter, while others offer an add-on switch for this feature. A number of gyros also have a third plug that permits the use of dual aileron or elevator servos—very convenient for dual-servo setups. Here are some benefits of using gyros in airplanes and which controls they can be plugged into:

Using a gyro on rudder

- Aids tail-dragger ground handling, especially on pavement.
- Smoothes nosewheel steering on high-speed, turbine-powered jet models; helps smooth out extremely fast ground run.
- May help minimize yaw corrections during the vertical portions of a stall turn.
- Helps to fly vertical and horizontal straight lines of all types—especially in crosswind situations.
- Smoothes out violent wingtip launches of hand-launched gliders.
- Prevents side-to-side oscillations on winch-launched gliders, so the pilot can concentrate on elevator and winch control.

Using a gyro on rudder and elevator

- Helps a modeler learn to torque roll, as the gyro corrects most of the yaw and pitch movements caused by the instability of the aircraft in a vertical hover.
- Helps to decrease pilot input needed for rolling maneuvers such as slow rolls and point rolls.
- Makes snaps, spins, tumbles and rolls stop instantly when the sticks are released.

Using a gyro on elevator

- Smoothes out the rearward center of gravity in pitch-sensitive designs.

Using a gyro on aileron:

- Makes aileron-sensitive models more stable.

Heli-Max Mini Piezo Gyro & Micro Piezo Gyro

The Heli-Max Mini Piezo Gyro w/Remote Gain Adjustment and the Micro Piezo Gyro are perfect for both helicopter and fixed-wing use. The Mini features remote gain adjustment (sensitivity) from your transmitter during flight, and it has a reversing switch, power monitor and Futaba J-compatible connectors. The Micro is just over 1-inch square and weighs less than 1 ounce, which makes it the perfect choice for smaller models. **Prices: Mini Piezo Gyro w/Remote $119.99; Micro Piezo Gyro $89.99.**

JR G450 Piezo Gyro

The first model manufacturing company to offer a piezo gyro, JR continues its groundbreaking trend with its G450 Piezo Gyro. With a footprint of less than 1½ inches square and weighing less than 1¼ ounces, the gyro is self-contained; it doesn't have amplifiers, so installation is a breeze. The satin chrome case reflects heat, and the gyro has long leads that eliminate the need for servo extensions. This high-performance gyro also features remote gain control from an auxiliary channel on your transmitter. **Price: $174.95.**

Expert EX-100 Aero Gyro

Intended for use with fixed-wing aircraft, the Expert EX-100 Aero Gyro with Aero Gain control is just about 1 cubic inch and weighs just over ½ ounce. Four adjustable parameters make this gyro easy to set up, and the Aero Gain unit can turn the gyro on and off with an auxiliary channel. **Price: $99.95.**

FMA Direct G90 & PC-1

The G90 piezo gyro and PC-1 remote gain-switch module from FMA Direct are affordable and lightweight and can be used with even the lightest helis and model airplanes. The gyro is solid state with a high-quality piezo element. It's easy to adjust and very compact and operates on the airborne battery pack; simply plug it into your receiver. For remote on/off control, plug the PC-1 into the gyro and then into an auxiliary channel of the receiver. **Prices: G90 $79.95; PC-1 $19.95.**

GYRO GLOSSARY

Angular: having to do with the angle of something turning. Angular rate is the rate at which an angle changes.

Damping: a measure of how fast a motion dies out. The higher the damping, the faster it dies out.

Gain: how the device reacts to inputs. The higher the gain, or sensitivity, the greater the reaction.

Heading-hold gyro: a gyro that adds stiffness to maintain the heading angle of an aircraft regardless of whatever else is going on.

Piezoelectric: a crystal that directly converts motion into measurable voltage.

Rate: the speed at which something changes. Higher rates equal faster changes.

Rate gyro: a gyro that provides damping and tries to maintain a constant turn rate; not to be confused with a heading-lock gyro.

Sense axis: an imaginary arrow that points in the direction around which the gyro senses rotation. For a helicopter, the sense axis should be parallel to the main rotor shaft.

Sensor: a device that can sense variations in temperature, light, or motion.

Stiffness: the quality that makes a system return to neutral after being disturbed.

Wing gyro: a gyro that is intended to "smooth" or "damp out" an aircraft's roll. These can be handy for twitchy models or for takeoffs and landings in gusty conditions.

Yaw: the angle the fuselage makes with respect to its heading. Most of the time, pilots want yaw to be zero.

Hitec RCD Inc. CG-130 Mini Piezo Gyro

Hitec recently released its CG-130 Mini Piezo Gyro with remote gain controller. This compact gyro is just over 1 inch square and weighs slightly more than ¾ ounce, so it's ideal for fixed-wing or heli applications. The remote gain controller allows dual gain-rates on helis and on/off settings for airplanes. The gyro is available with or without the remote gain controller, and with a two-year warranty, this gyro is sure to be popular. **Price: $143.95 (with remote gain controller).**

Hobby Lobby Ikarus Tele-Gyro, Wing Gyro & Micro Gyro

At less than an ounce, the Tele-Gyro has a lot to offer. This single-axis, single-servo gyro features gain adjustment from an auxiliary channel and stick priority over the gyro. The more the stick moves from neutral, the less effect the gyro has. The gyro also has a reversing switch and operates from the airborne battery pack. The Ikarus Wing Gyro has the same features as the Tele-Gyro but offers dual-servo-control setups and allows flaperon- or aileron-speed brake programming if offered in the transmitter programming. The diminutive Ikarus Micro Gyro is the smallest gyro available, but it can control large airplanes. The plug-and-play unit weighs about 5 grams and draws only 10mA from the airborne battery pack. **Prices: Ikarus Tele-Gyro $84; Ikarus Wing Gyro $84; Ikarus Micro Gyro $65.**

Cirrus MPG-10 Micro Piezo Gyro & In-Flight Switch

This plug-and-play has a single-rate-gain adjustment and weighs 7 grams with the plastic case and 4.8 grams without it. At a little more than 1-inch square, the gyro can fit into very small spaces. Those who want remote gain can also buy the GS-10 Gyro In-Flight Switch. The gyro is compatible with all RC systems. **Prices: MPG-10 Micro Piezo Gyro $49.99; GS-10 In-Flight Switch $14.99.**

HEADING-HOLD—WHAT IS IT?

If you've looked at gyro ads, you've probably noticed the terms "heading-hold" or "heading-lock" and wondered what they mean. Let's use a helicopter tail rotor as an example. A regular gyro (mechanical or piezo) helps damp out unwanted movements that are either pilot- or wind-induced; an example of such a movement would be a hover in a gusty crosswind. The wind causes the heli

to yaw into the wind, the gyro directs the tail rotor to counter the yaw in the opposite direction, and the pilot still needs to counter the yaw with tail-rotor input. If the heli hovered in the same crosswind in heading-hold mode, the gyro would resist any yaw motion and would lock in the last given heading.

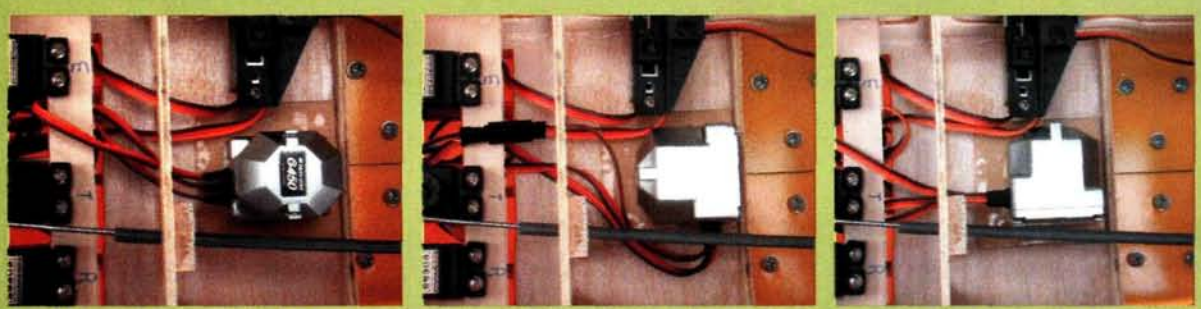
Another way to think of heading-hold is to look at how a car suspension works. A coil spring around a shock absorber always wants to go back to its neutral position. The harder the spring is compressed, the more quickly it returns to its balanced state.

Heading-hold is very popular with heli pilots, as it makes possible many of the backward and sideways 3D maneuvers. Fixed-wing pilots have recently used heading-hold for torque rolls and other maneuvers that demand extreme skill to perform.

GYRO INSTALLATIONS AND CONSIDERATIONS

To get maximum performance from a gyro, there are a few things you'll need to consider. First, be sure to mount the gyro away from any heat sources (engine/muffler), as the piezo sensors are very sensitive to heat. If there are drastic temperature changes, the neutral setting of the gyro will change. Use rubbing alcohol to thoroughly clean the gyro-mounting surface and the mounting position in the aircraft. Also, mount the gyro on a hard, smooth surface, as the mounting tape will not properly adhere to bare wood. (If the gyro comes loose during flight, the plane may not be controllable.)

Mount the gyro as close as possible to the center of gravity and in the correct orientation for the axis being controlled. Piezo gyros respond more quickly to movement than the older mechanical gyros, so a servo with fast transit time and accurate centering tendencies should be used. There is no need to change to a larger battery pack, as current consumption for piezo gyros is very low—10 to 30mA. Most of all, carefully read the instructions and become familiar with the operating features and functions of the gyro. Always check the gyro for proper operation before flying; if the gyro is mounted for rudder control, yaw the fuselage to the right and check to make sure that the gyro corrects rudder to the left.

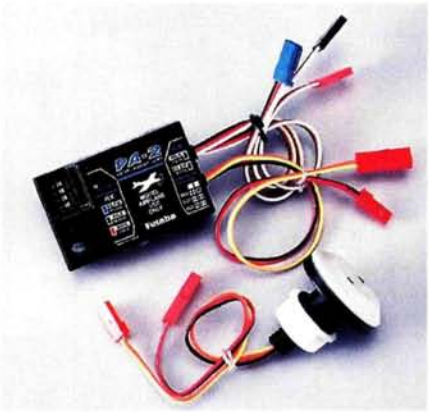


Left: this gyro installation is for rudder control; the gyro is positioned as close to the CG as possible and mounted 90 degrees to the centerline of the fuselage. Center: here, the gyro is positioned for aileron control. The gyro has been rotated 90 degrees counterclockwise and then laid on its side so the sensor is 90 degrees to the axis of the surface being controlled. If the unit has a reversing switch, make sure it's accessible. Right: for elevator control, the gyro is still on its side but has been rotated 90 degrees clockwise so the sensor is 90 degrees to the elevator axis.

Auto Pilots

These units are just incredible! An autopilot is possibly the ultimate pilot-training accessory. If a novice pilot gets into a difficult flying situation, an autopilot can help him regain control. With an autopilot, simply let go of the sticks, and the model will right itself; learning to fly will be much easier.

Most autopilots usually connect to the aileron and elevator, and if you have an auxiliary channel on the receiver, then you can make in-flight gain (sensitivity) adjustment during flight. Like gyros, the desired autopilot servos are connected to the unit and then plugged into the receiver. The biggest difference between gyros and autopilots is that the autopilot sensor is externally mounted, preferably away from exhaust residue. Autopilots can also be used with the fail-safe features of most PCM radio systems—an excellent safety idea.



Futaba PA-2

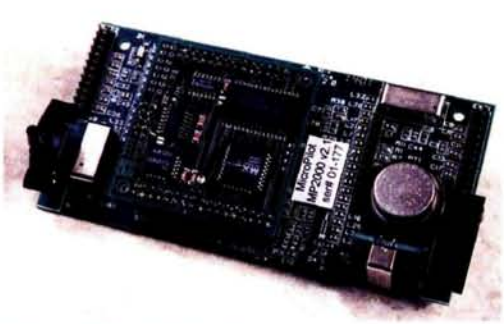
A sudden loss of orientation—such as flying through the sun—can spell disaster for your model. You can avoid the need to master rebuilding skills with the Futaba PA-2 Pilot Assist Link Autopilot. The PA-2 uses an optical sensor to "see" variations between the sky and horizon, so if you get into trouble, all you need to do is release the sticks; the unit stabilizes the plane with corrections to roll and pitch. The unit's sensitivity can be adjusted for minimum to maximum input, depending on your confidence at the controls. **Price: $49.95.**

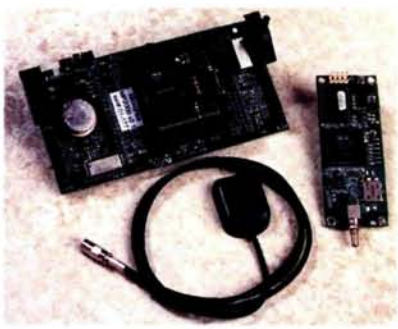
FMA Co-Pilot

The FMA Direct Co-Pilot Flight Stabilization System (FSU) is a patented system that senses the difference in infrared (temperature) signature between the earth and the sky on any two axes of the model. Fly the model normally, release the sticks, and the model will immediately right itself—even from inverted flight! Gone is the need for a buddy box! **Price: $119.95.**

MH AutoSpeed

With the MH AutoSpeed, gone are the worries about going too fast and inducing control flutter. Today's turbine engines can propel model jet airframes well beyond their limits, and that can have disastrous results. With the AutoSpeed, you can set the maximum and minimum aircraft speeds. The modeler determines the safe speeds and presets them into the unit. When activated, the pressure sensor and the microprocessor sense the airspeed, and the AutoSpeed will reduce throttle if the maximum speed is exceeded, or add throttle if speed falls below the minimum set speed. The unit also has an automatic mode, or cruise control, to maintain a comfortable speed; the AutoSpeed can be turned on and off during flight. **Price: $185.**



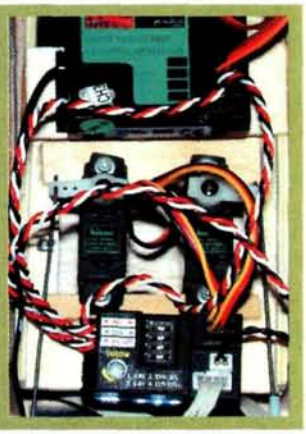


MicroPilot MP1100

The MP1100 is a multi-function, high-end autopilot that is perfect for an RC trainer. Its capabilities include: airspeed hold, turn coordination, altitude hold and GPS navigation. This unit interfaces with any 5-channel receiver and supports up to eight servos. You can even use flaperons, V-tail and elevon mixing! It includes the required sensors and GPS receiver. **Price: $1,800.**

Autopilot installation

Unlike most gyros, autopilots' sensors are mounted externally, usually on the bottom of the fuselage. All that's needed to access the control box is a small hole near the sensor for the signal cable. Follow the same mounting guidelines as you would with a gyro (smooth, clean mounting surface, etc.). Also, to function properly, the sensor pick-ups must have an unobstructed sightline both fore/aft and left/right. The control box can be mounted in any convenient location. At right, it's plugged into the receiver and the servos are plugged into the control box. Again, follow the manufacturer's directions.



Ugly Sticks do great aerobatics and have been around for many years. I doubt that any flying club hasn't had several on the flightline at one time or another. They're durable and make a great second model after you've graduated from a trainer. The Ultra Stick 40 is Hangar 9's latest entry in the ARF (almost-ready-to-fly), .40-size market. It's a low-cost aerobatic model for those who want to push the aerobatics envelope. With oversize control surfaces and the option to mix in flaps for different flight configurations, this Stick offers outstanding performance.

by Craig Trachten

Hangar 9 Ultra Stick 40

WHAT'S IN THE BOX?

The Ultra Stick 40 is very similar to its larger, 1.20-size brother. It's prebuilt from lite-ply and balsa and covered with UltraCote. The parts are well packed and sealed in plastic bags to prevent them from being damaged during shipment. The kit includes all the necessary hardware to build it in either standard configuration or with the optional quad flaps. The supplied universal engine mount will accept most engines in the .40 to .58 2-stroke and .50 to .72 4-stroke ranges. The comprehensive, photo-illustrated manual is very thorough and includes programming details for several radio systems.

ASSEMBLY

• **Wings.** First you must decide whether to build the standard or the quad-flap version. I wanted to use some of my radio's programming features, so I built it with quad flaps. Slide the CA hinges into the ailerons and flaps, and then fit them into each wing half; check that each control surface deflects fully without binding. Then, using thin CA, glue each hinge into place. I sealed the gap between the control surfaces and the wing with strips of self-adhesive trim; you could use strips of UltraCote, as described in the instructions.

PHOTOS BY WALTER EDIAS

The ultimate fun-fly stick

SPECIFICATIONS

MODEL: Ultra Stick 40

MANUFACTURER: Hangar 9

DISTRIBUTED BY: Horizon Hobby

MODEL TYPE: sport aerobatic ARF

LENGTH: 51 in.

WINGSPAN: 57¾ in.

WING AREA: 715 sq. in.

WEIGHT: 6 lb., 1.5 oz.

WING LOADING: 19.65 oz./sq. ft.

ENGINE REQ'D: .40 to .58 2-stroke or .50 to .72 4-stroke

ENGINE USED: Saito .72 4-stroke

PROP USED: APC 13x6

RADIO REQ'D: 4-channel w/5 servos (standard configuration), 5-channel with mixing and 7 servos (quad-flap configuration)

RADIO USED: Futaba 8UAP transmitter and 127DF receiver; servos: 2 Futaba S3003s (rudder, elevator), FMA S330 (throttle), 2 FMA S360s (flaps), 2 FMA S3601s (ailerons)

FUEL USED: Wildcat 30% heli

STREET PRICE: $129.99

FEATURES: prebuilt and covered with UltraCote; complete hardware package; aluminum landing gear; wheels; comprehensive, photo-illustrated instruction manual.

COMMENTS: easy to build and fun to fly. The instruction manual makes programming the many flight features into a computer radio easy to do.

HITS
- Easy to build.
- Thorough programming instructions.
- Complete hardware package.
- UltraCote covering.
- Impressive flight performance.

MISSES
- None.

Next, glue the wing halves together. The manual recommends that you place wing halves in a plastic bag to protect them from epoxy, but I found this a little awkward. I couldn't get a nonslip grip on the wing halves, so before starting assembly, I wrapped a piece of ¾-inch-wide masking tape around the wing roots to protect them. Epoxy the roots and joiner together and set aside until the epoxy has cured.

For the quad-flap option, you'll need four standard servos (two aileron, two flap) and servo extensions for each. Be sure the extensions are long enough to allow you to work comfortably; remember, each servo gets unplugged when you remove the wing. I used heat-shrink tubing to secure the servo extensions so that they won't come apart during flight. It helps to use four colors of tape or paint dots to code each servo extension after you've installed the servos in the wing.

Now fit the wing to the fuselage. I rounded the ends of the dowels and epoxied them into the wing's leading edge. Make sure that at least ½ inch of dowel protrudes from the wing. Slide the wing onto the fuselage, square it up, and mark its position on each side of the fuselage. Remove the wing, and thread the wing bolts up from the bottom until they are just above the wing saddle. I then dabbed the tops of the bolts with black acrylic paint and reinstalled the wing to match the marks I had made earlier. The paint will be transferred to the bottom of the wing and will show you where to drill the bolt holes. After you have drilled the holes, attach the wing-bolt plate to the top of the wing.

• **Empennage.** On the horizontal stabilizer, draw a centerline from the leading edge to the trailing edge; also, on the fuselage, draw a centerline on the stabilizer saddle. Place the stabilizer on the saddle and check its alignment. Make adjustments, if necessary, and as you did on the wing, mark the stabilizer where it meets the fuselage. Remove the covering from the stabilizer just inside the marks, and epoxy the stabilizer to the fuselage. Install the vertical fin in the same fashion, making sure it's perpendicular to the horizontal stabilizer.

Trial-fit the rudder to the fin; mark and drill where the tailwheel wire guide will be inserted into the rudder. I cut a V-groove in the rear of the fuselage for the tailwheel pivot bushing. Epoxy the tailwheel assembly into the rear of the fuselage, and then insert the hinges into the fin and rudder and secure them with thin CA. Repeat the process and attach the elevators to the horizontal stabilizer. As I did on the wing, I sealed the gaps on the empennage control surfaces.

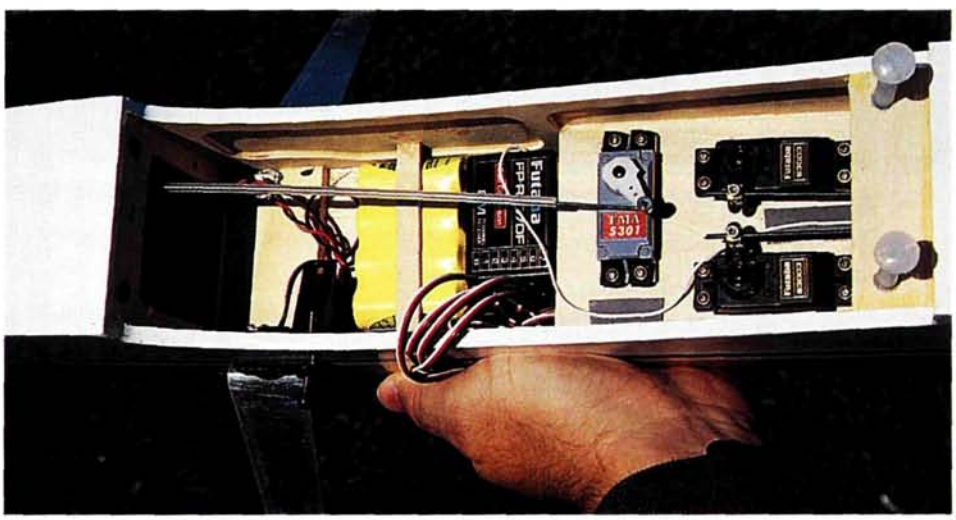
• **Fuselage.** Attach the axles and wheels, and secure them to the aluminum landing gear; then screw the completed assembly to the fuselage. Because the engine is exposed, I used fuel line in two colors for the standard two-line setup. This eliminates the chance that I'll attach the wrong line to the carburetor. Using the included fuel tank and hardware, I plumbed the tank as instructed and inserted it into the fuselage after I had bolted the engine mount into place.

I test-fit my Saito FA-72 4-stroke engine on the universal engine mount, secured the mount to the firewall with four screws and then slid the fuel tank into place behind the firewall. Then I bolted the engine onto the mount and secured it with the included hardware. Before I tightened the straps, I added a few degrees of downthrust.

• **Radio installation.** Use servos of standard size for regular control, but for a crisper control response, use faster servos with more torque. It is most important that you use matching servos for the ailerons and flaps to ensure equal deflection and response.

I used an assortment of Futaba and FMA servos and a Futaba 127DF receiver and 8UAP transmitter. I finished installing the radio with the supplied pushrods and control horns and other necessary items, such

The radio compartment has plenty of room for all the components. Note the servo extensions on the receiver; they're connected to the servos in the wing.



FLIGHT PERFORMANCE

TAKEOFF AND LANDING

My first takeoff and landing was straightforward—no surprises from a proven design. I throttled up slowly until the Ultra Stick lifted off, which happened at approximately ½ throttle. At altitude, I made some minor trim adjustment for hands-off, level flight. After a few laps, I chopped the throttle and landed the model mid-field. Everyone got the impression that I was a good pilot by the way the aircraft touched down and rolled to a gentle stop.

LOW-SPEED PERFORMANCE

The Ultra Stick 40's slow-speed flight characteristics are as good as any I have ever seen. Stalls are nonevents with no surprises. There is no reason why this model couldn't be used as a first aircraft; it doesn't have any bad tendencies.

HIGH-SPEED PERFORMANCE

I punched the throttle, pulled up, and the plane went vertical to become a dot in the sky very quickly. On the way down, I jammed the sticks every which way, and the aircraft's response was crisp and sharp. I was able to recover to straight and level flight with minor control input. As with slow-speed flight, there are no bad tendencies at high speed.

AEROBATICS

This is what this aircraft was designed to do. Inverted flight was as easy as right-side up; loops, rolls and spins can happen so fast that you may get dizzy! Knife-edge flight is easy and requires very little cross control. With aileron/flap mixing, elevator/flap mixing and crow activated, many types of aerobatics are possible. Just imagine pointing the aircraft straight down and activating crow (both ailerons up and both flaps down) and having to wait for the plane to come down. You can have a conversation with someone before the model gets anywhere near the ground. On more than one occasion, everyone thought I would crash the Ultra Stick. At mid-field with a gentle headwind, I floated the plane to the ground from 20 feet up in less than 20 feet of forward movement. Now, that's fun!

as the switch harness and the receiver battery. Make sure the aileron and flap servo arms point out toward the wingtips, or you'll have trouble setting up your controls. Guess how I found out!

The comprehensive instruction manual explains several setups and the use of the quad flaps; 35 pages take you step by step through the programming for the flight configurations of which the Ultra Stick is capable. Don't let this frighten you! The instructions show setups for nine JR radios and the Futaba 8UA that I used. Hangar 9 couldn't have made it any easier, and that alone earns it a double thumbs-up from me.

Right: to use the quad-flap capabilities, you need a computer radio with four servos in the wing—two for the ailerons and two for the flaps. The Ultra Stick can also be set up in a standard configuration without flaps. Below: the included universal engine mount accommodates many types of engine, and installation is super simple.

CONCLUSION

Hangar 9's Ultra Stick 40 is a great ARF version of an old favorite. It can be built quickly and easily, and you will really wow them at the field with its many tricks. If you're looking for an inexpensive sport model to put that computer radio in, Hangar 9's Ultra Stick 40 is a fine choice.

***FMA Direct**, 9607 Dr. Perry Rd., Unit 109, Ijamsville, MD 21754; (800) 343-2934; fax (301) 831-8987; www.fmadirect.com.*

***Futaba Corp. of America;** distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 637-7660; www.futaba-rc.com.*

***Hangar 9;** distributed by Horizon Hobby Inc.*

***Horizon Hobby Inc.**, 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; fax (217) 352-0355; www.horizonhobby.com.*

***UltraCote;** distributed by Horizon Hobby Inc.*

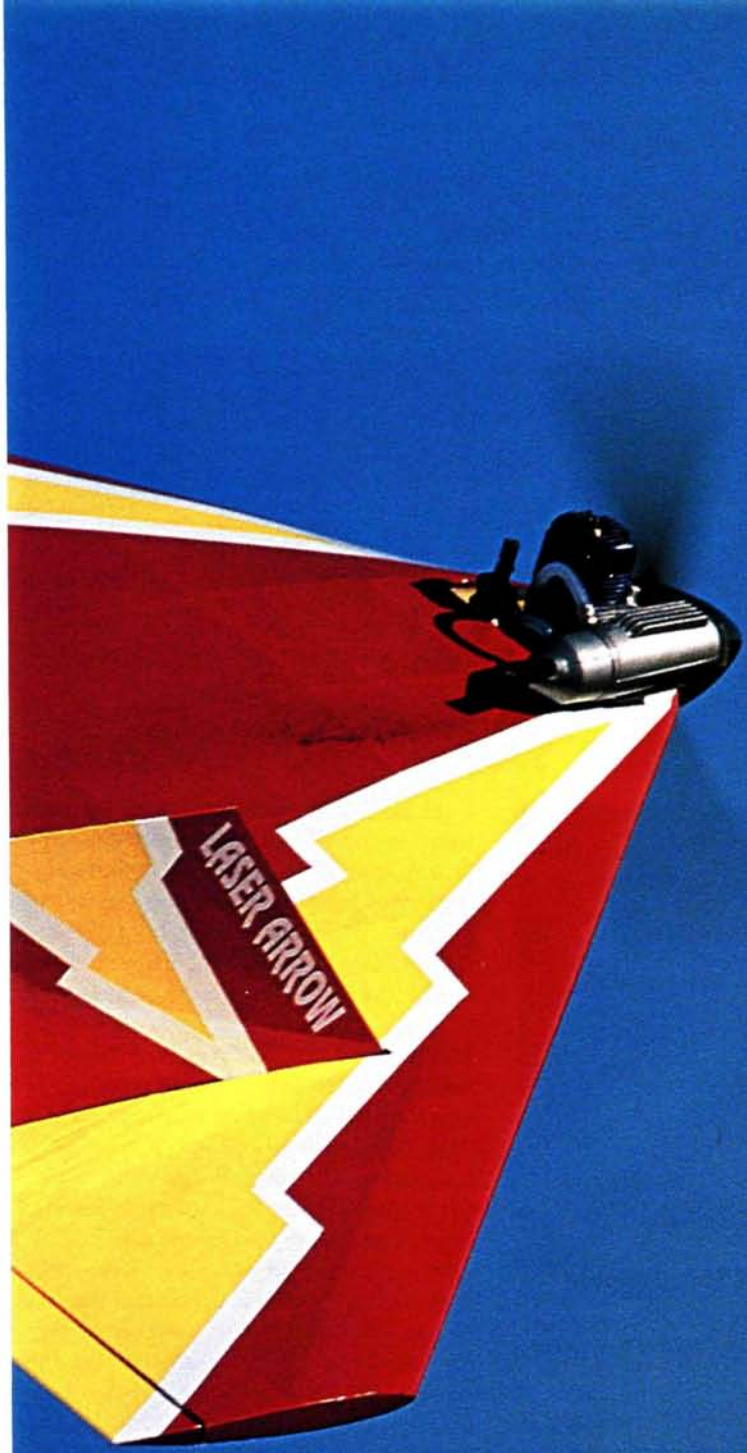
A sweet flying delta wing

Laser Models Laser Arrow

by Stan Kulesa

There's something eye-catching about a "delta-wing" type of aircraft. The mystique of an airplane with no fuselage or empennage piques our curiosity and challenges our instincts concerning aerodynamics. The Laser Models Laser Arrow delta wing is one in a new line of models distributed by Great Planes, and I quickly accepted the offer to review it.

Laser Models employs laser-cutting technology and claims that its Laser-Lock Building System ensures a lightweight airframe that's straight and strong.



SPECIFICATIONS

MODEL: Laser Arrow

MANUFACTURER: Laser Models

DISTRIBUTOR: Great Planes Model Distributors Co.

TYPE: sport delta wing

WINGSPAN: 39⅜ in.

WING AREA: 690 sq. in.

WEIGHT: 3 lb., 10 oz.

WING LOADING: 14.1 oz./sq. ft.

ENGINE REQ'D: .21 to.61 2-stroke or .52 4-stroke

ENGINE USED: O.S. .46 LA

PROP USED: APC 11x6

RADIO REQ'D: 4-channel w/4 servos (throttle, elevator and 2 for ailerons), or 3 servos w/delta-wing mixing (throttle and 2 for elevons)

RADIO USED: Airtronics Spectra PCM

FUEL USED: Morgan Fuel Cool Power 15%

LIST PRICE: $89.99

FEATURES: kit includes laser-cut balsa and plywood parts; 8-ounce fuel tank; 16-page instruction manual; unique interlocking construction; decal sheet; complete hardware package.

COMMENTS: no extras are needed to finish the Laser Arrow other than glue, covering material, radio gear, an engine, a prop and a spinner. The unique Laser-Lock construction method goes together quickly and ensures a lightweight, strong and straight airframe. I'm having a blast flying this model!

HITS

- Accurately laser-cut parts and interlocking construction.
- High-quality materials.
- Speedy construction.

MISSES

- Awkwardly written instructions.

THE KIT

The kit consists of several sheets of laser-cut balsa and light plywood. To minimize damage, the wood sheets are secured to the bottom of the box with cardboard tabs. The hardware package is complete and includes pinned hinges, screws, clevises, control horns, a fuel tank and other assorted parts. There is also a Nyrod (for throttle) and threaded-wire pushrods. The Laser-Lock building technique is very interesting; no plan is provided, nor is one needed. Instead, the building process relies on accurately laser-cut parts and interlocking tab-and-slot construction to ensure proper alignment.

CONSTRUCTION

The translated step-by-step manual is a little awkward to read, but each construction step is complemented by a 3D exploded illustration and a photograph of above-average quality; these help to clarify the written instructions.

Laser Models markets its products worldwide, so the instruction manual is written in four different languages, and I found it very useful to highlight the English instructions. That way, I didn't accidentally miss any steps. Metric measurements are used throughout the kit; in this article, I've converted them so they approximate standard inches.

To build the Laser Arrow, I used a variety of Great Planes adhesives such as Thin Pro CA and Thick Pro CA, and for high-stress joints, Great Planes Epoxy. Construction begins with an ⅛-inch plywood assembly, through which the landing skid passes; the Laser Arrow has no wheeled landing gear. This assembly, the engine mount, some

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

Hand-launching the Laser Arrow is easy; have your helper grip the skid, accelerate to full throttle and toss the model straight and level (like throwing a baseball). Following the launch, there's a brief dip, but airspeed quickly builds up. Landings are easy; throttle the engine back, and guide the plane to your touchdown point. Be sure to set your throttle so your engine quits at full low throttle and at full low-throttle trim.

LOW-SPEED PERFORMANCE

Because of the delta-wing design, the Laser Arrow can fly very slowly. The model is very hard to stall and offers no surprises. The glide ratio is awesome; I was amazed to see how far the model could glide without power.

HIGH-SPEED PERFORMANCE

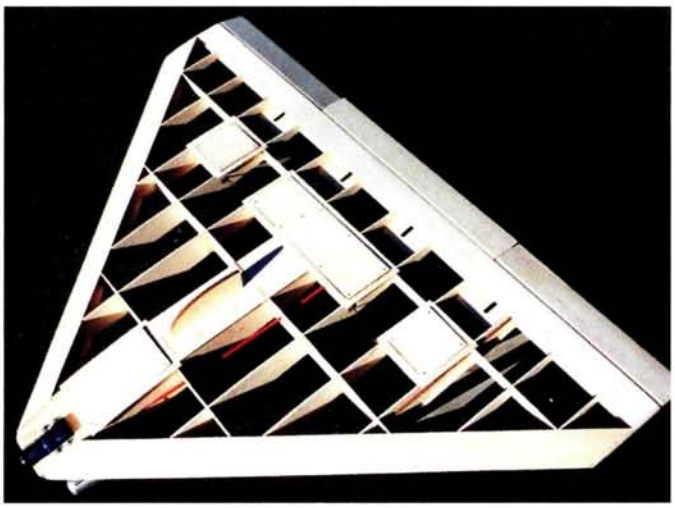
I powered the model with an O.S. .46 LA, but the Laser Arrow can accommodate up to a .61 2-stroke. This is noteworthy because the plane moves quite briskly with just the .46. No trim changes are necessary between low and high speeds. Wind penetration and vertical flight performance are excellent.

AEROBATICS

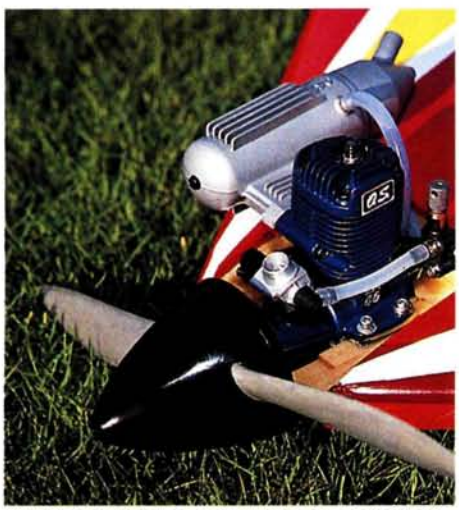
The delta-wing design is excellent for aerobatics. Large loops are easy to do, and the roll rate is awesome. Two rolls per second on low rates and four rolls per second on high rates are the norm. Even though the model has no rudder, the airspeed will hold knife-edge flight for some distance before dipping. Spins—both upright and inverted—start slowly at first but become progressively tighter. Inverted flight requires very little down-elevator, although inverted loops required quite a bit of down-elevator and were not nearly as large as inside loops. The Laser Arrow excels at aerobatics and, of course, has the unique look of a delta wing.

corner gussets and the servo mounts are the only plywood parts in the model; everything else is constructed of balsa. You can understand how Laser Models has succeeded in keeping down the model's weight.

Begin construction with the skid assembly. Three small balsa formers are glued to two ⅛-inch-balsa wing spars and are then slipped into place between two balsa core ribs. Next, these are slipped into three spars into which slots have been cut for the rest of the ribs and formers. The framed-up assembly resembles a tic-tac-toe grid and makes it very easy to keep the assembly square. The model has 14 fully symmetrical, ⅛-inch-balsa ribs, and the leading edge is notched so it slips into place through the fore end of all the ribs. I added the leading- and trailing-edge sheeting last and then sanded the airframe smooth.



Four hatches provide access to the servos, the radio compartment and the fuel tank. Note the fin-like landing skid.



Engine installation is easy and can accommodate a wide range of engines, from a .21 to .61 2-stroke.

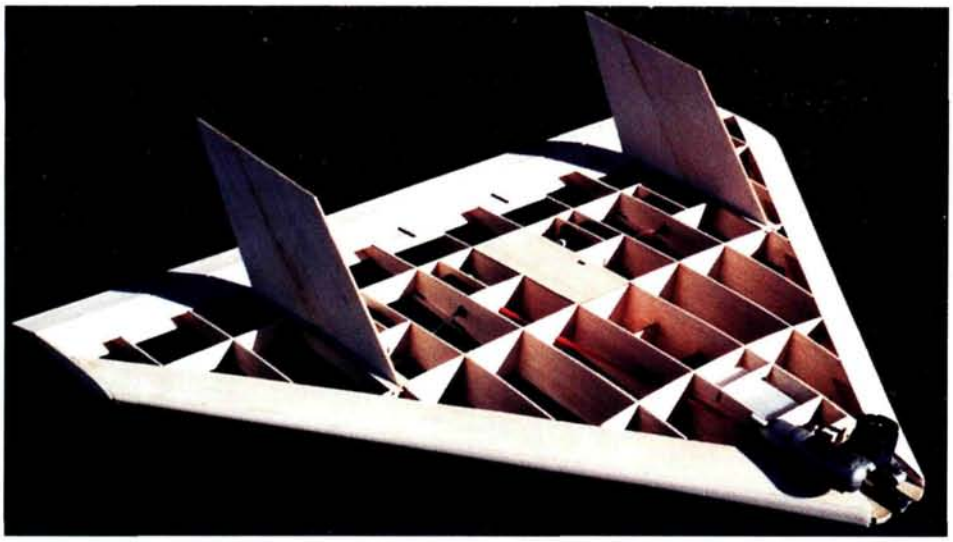
The Laser Arrow's twin fins have no rudders and are built out of two pieces of ⅛-inch-balsa sheet that are butt-glued together. The elevator and ailerons (or elevons) are made of 2-inch tapered balsa. Because of the stresses placed on the control surfaces, I was pleased to see that the balsa for the elevons is of a superior grade with a tight grain. The model uses four hatches for access to the fuel tank, each servo, the battery pack and the receiver.

I built the engine mount by sandwiching two, laser-cut, ⅛-inch plywood pieces together and then cutting out the opening for my engine. To ensure that the mounting holes for the engine were properly aligned, I used my Great Planes Dead Center Hole Locator. I then installed the engine and the supplied, 8-ounce fuel tank.

• **Radio and engine.** The Laser Arrow is suitable for either a basic radio system or one that has delta-wing mixing; I used a basic radio without mixing. If your radio has mixing and you use it on this model, the control surfaces are cut in half and use three servos—one for throttle and one on each elevon. If your radio system does not have mixing capability, the control surfaces are cut into thirds and use four servos: one for throttle, one for each aileron and one for elevator. The servos are side-mounted on plywood trays, and I used socket-head screws to mount them; access to the screws can be difficult, and the socket-head screws make access easier. The instruction booklet gives the amount of throw for each control surface; I followed its recommendations exactly and had excellent flight results.

To power my model, I chose an O. S. .46 LA 2-stroke engine swinging an APC 11x6 fiberglass propeller. I also added a Great Planes 2½-inch spinner.

• **Finishing.** This is the kind of model you can have a lot of fun designing a trim scheme for. Initially, I was tempted to finish it so it looked like a "yield" sign. I also considered covering it with aluminum MonoKote and trimming it with military jet-aircraft insignias. One important issue to be mindful of when designing the finish for



Here's the model ready for covering; I used MonoKote with great results. Note the interlocking and self-aligning construction—it's easy to build and very strong.

a delta model is to be able to differentiate the top of the model from the bottom while it's in flight. I chose to cover the bottom of the Laser Arrow with yellow MonoKote and the top with true red trimmed with yellow and white lightning bolts.

CONCLUSION

I was very impressed with the ease and speed of construction of the Laser Models Laser Arrow. The wood was of above-average quality; there were no warps, twists, or cracks, and the quality of the laser cutting was impressive. The interlocking, self-aligning, slot-and-tab construction delivered on the promise of superior strength. It took me approximately 14 hours to complete this project—less time than I've spent on many ARFs! Best of all, if your work area is somewhat small, you won't need much room to build the Laser Arrow; this is a big plus. And it flies the way a delta wing should—quick and maneuverable. It always draws a big crowd at the field.

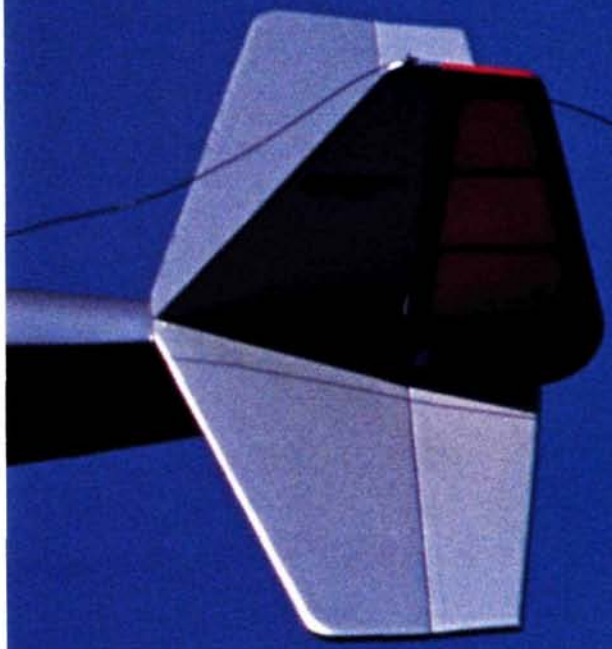
__Airtronics__, 1185 Stanford Ct., Anaheim, CA 92805; (714) 978-1895; fax (714) 978-1540; www.airtronics.net.
__APC Props__; distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.
__Great Planes Model Distributors Co.__, P.O. Box 9021, Champaign, IL 61826-9021; (800) 637-7660; fax (217) 398-0008; www.greatplanes.com.
__Horizon Hobby Inc.__, 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; fax (217) 355-1552; www.horizonhobby.com.
__Laser Models__; distributed by Great Planes.
__MonoKote__; distributed by Great Planes.
__Morgan Fuel__; distributed by Horizon Hobby.
__O.S.__; distributed by Great Planes.

Fun-fly fighter

by Rick Bell

Thunder Tiger Lazy Tiger 51

When North American Aviation's designers created the P-51 Mustang, they never dreamed it would become a modeling favorite. It has been built in sizes ranging from peanut-scale, rubber-powered models to giant-scale RC. Thunder Tiger's Lazy Tiger 51 is a fun scale, relaxing model that can perform aerobatics low and slow.

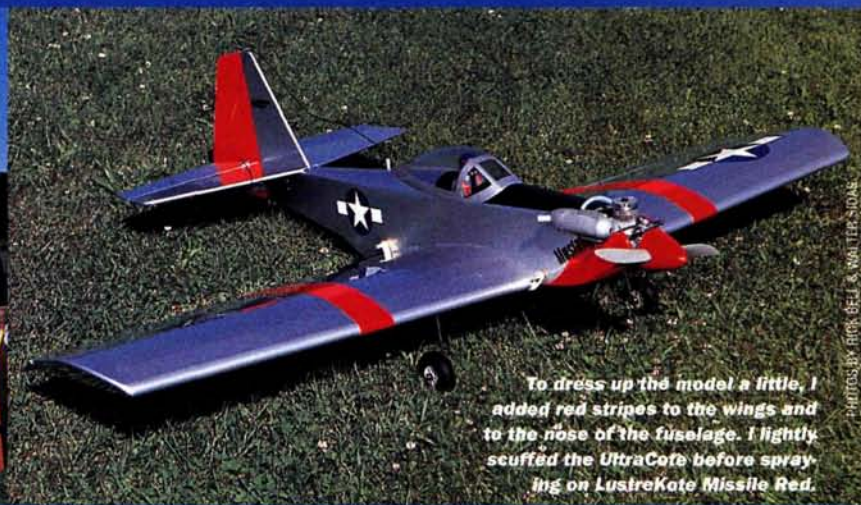


KIT CONTENTS

The Lazy Tiger 51 kit is very complete. All of the main parts, the fuselage, wing and tail feathers are well built and nicely covered in UltraCote. All of the necessary hardware is also included, as are an adjustable engine mount, canopy, wire landing gear, wheels, spinner and decals. The photo-illustrated manual is very thorough and includes a list of recommended tools and materials to complete the model. When I inspected the contents, I could see that this airplane was going to be quick and easy to build, and I was right. It took only about 6 hours to be ready for the field, and that's including the paint trim I added to the fuselage and wing.

ASSEMBLY

• **Wing.** As with most ARFs of this type, assembly is simple and the instructions are very good—lots of detailed photos with step-by-step directions. Assembly starts with the wing. I used slow-setting epoxy to laminate the three plywood dihedral braces together and then clamped them together while the epoxy cured. After fitting the dihedral brace to the panels (my brace was too long), I joined the wing halves using the brace, plenty of epoxy and some tape. Next, I hinged the ailerons to the wing using the supplied CA hinges and thin CA. Each aileron is controlled by its own servo, and there are cutouts in each wing panel for either standard (my choice) or miniservos.



To dress up the model a little, I added red stripes to the wings and to the nose of the fuselage. I lightly scuffed the UltraCote before spraying on LustreKote Missile Red.

PHOTOS BY RICK BELL & VAN TER SOAK

SPECIFICATIONS

MODEL: Lazy Tiger 51

MANUFACTURER: Thunder Tiger

DISTRIBUTED BY: Ace Hobby Distributors

TYPE: sport aerobatic ARF

LENGTH: 42 in.

WINGSPAN: 53.5 in.

WING AREA: 740 sq. in.

WEIGHT: 3.2 lb.

WING LOADING: 9.98 oz./sq. ft.

ENGINE REQ'D: .20 to .30 2- or 4-stroke

ENGINE USED: Thunder Tiger Pro-25 2-stroke

PROP USED: APC 9x6

FUEL USED: Morgan Fuel Cool Power 15%

RADIO REQ'D: 4-channel w/5 servos (throttle, elevator, rudder and 2 servos for aileron)

RADIO USED: JR X388S

PRICE: $119.99

FEATURES: built-up balsa and ply construction with UltraCote covering; pre-hinged control surfaces; complete hardware package; photo-illustrated construction manual.

COMMENTS: the Lazy Tiger 51 is an easy-to-build and easy-to-fly ARF model; assembly takes only a few short hours. Slow-flight capabilities are its forté, and this plane makes a great low-wing trainer.

HITS
- Easy to assemble.
- Very good instruction manual.
- Relaxing to fly.
- Looks good.

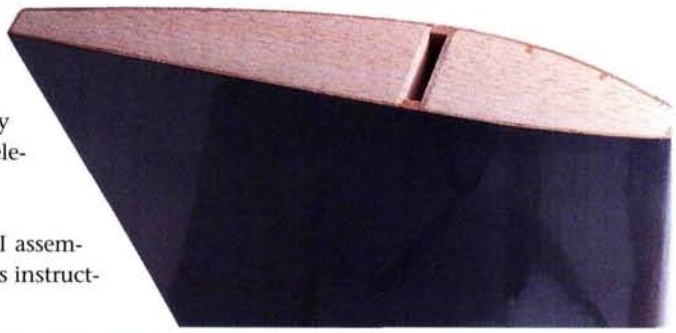
MISSES
- None.

The Thunder Tiger Lazy Tiger 51 is a very complete ARF; assembly takes only about 6 hours. Because the model is covered in UltraCote, it's easy to match the color for repairs.

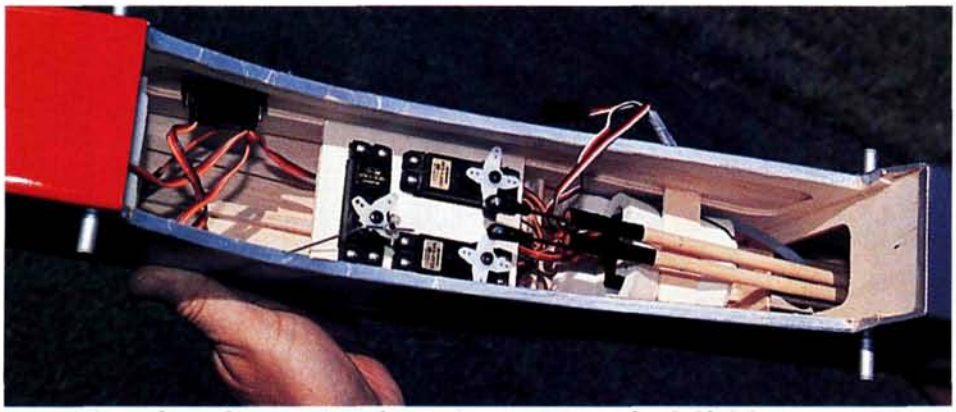
leads. I mounted the servos, made the linkages from the supplied materials and then mounted the landing gear on the wing. This completed the wing assembly.

• **Tail assembly.** I prepped the tail feathers for assembly by removing the covering material from where the feathers are glued together. I used a slow-setting epoxy to glue them together and a triangle to square everything up. Before the tail feathers can be glued to the fuselage, you'll need to install the pushrods; access is limited in the rear of the fuselage for the elevator pushrod. After you've glued the tail assembly to the fuselage, install the tailwheel assembly and hinge the rudder and elevators.

• **Fuselage and radio.** First I assembled the supplied fuel tank as instructed. I then attached a single length of fuel line to both tank nipples, and with a piece of wire with a hook on one end, I pulled the fuel line/tank assembly into the fuselage. To power the model, I used a Thunder Tiger Pro-25, which I mounted on the supplied adjustable engine mount. Because the thrust line is a little low, I needed to cut a relief in the nose so the muffler would clear the fuselage side. I installed the servos, attached the control horns to the rudder and elevators and hooked up the pushrods with no fuss. The wing is mounted on the fuselage with rubber bands—simple, but disappointing. I prefer a standard dowel-and-nylon-bolt setup.



The Lazy Tiger is very well constructed. All joints were tight and securely glued. Here is the left wing panel root; notice that all of the joints are gap-free.



There's plenty of room for the radio equipment. I mounted the receiver behind the servos and the receiver battery under the fuel tank; the CG was perfect.

I cut away the covering material for the servos and also removed the covering from the landing-gear blocks and from the holes in the top of the wing for the aileron servo

Aileron linkage is a straight shot to the ailerons. Pockets are provided to use either standard or miniservos (standard servos are shown here).

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

It doesn't get any easier than this; point the nose into the wind, advance the throttle, and you're airborne in a matter of feet. Landing the model is just as easy; because the model slows quickly when throttle is reduced, you can use a very short landing approach. Precision spot landings are the norm for this model.

LOW-SPEED PERFORMANCE

This is where the Lazy Tiger shines! With its low aspect ratio wing, high-lift airfoil and light weight, low, slow and tight aerobatics are routine. The model is very hard to stall but when it does, it has no snapping tendencies.

HIGH-SPEED PERFORMANCE

With the Thunder Tiger Pro-25 in its nose, the plane flies well at high speed; I did, however, have to add a little down-trim to maintain level flight. Because the control surfaces are a bit large, I recommend that you use low rates and throttle management to eliminate the possibility of control flutter.

AEROBATICS

The Lazy Tiger 51 performs aerobatics with ease. It doesn't matter whether they're done fast or slow; the 51 can handle them! From loops, rolls, Cubans and any variation of these maneuvers, the model is very solid. For more aggressive maneuvers, I used the ailerons as flaps and mixed them with elevator (when the elevator goes up, the ailerons go down and vice versa) for really tight square loops and other types of loop maneuvers.

To add a little flair to the model, I added an old WW II pilot figure to the cockpit and then trimmed and added the canopy. The vacuum-formed air scoop is just glued onto the bottom of the wing. I mounted the wing on the fuselage and slid the scoop a little farther back than instructed; this helps key the wing to the fuselage. To add a little color to the model, I decided to paint the nose of the fuselage and add stripes to the wing. I masked off the areas to be painted, scuffed the covering with a Scotch-Brite pad and used LustreKote Missile Red paint. When the paint had dried, I applied the decals and balanced the model; no additional weight was needed.

The recommended Thunder Tiger Pro-25 proved to be a good match. With an APC 9x6 prop, performance was very good.

FINAL THOUGHTS

The Thunder Tiger Lazy Tiger 51 is a very easy model to assemble. It is well constructed, all of the glue joints were tight, and the factory-applied covering was expertly done. But the best part of the Lazy Tiger 51 is how well it flies. Its slow flight characteristics are a real confidence builder. It would also be a great low-wing trainer.

APC Props; *distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

Ace Hobby Distributors, *2682 Walnut Ave., Tustin, CA 92780; (714) 544-0633; www.acehobby.com.*

Great Planes Model Distributors Co., *P.O. Box 9021, Champaign, IL 61826-9021; (800) 637-7660; fax (217) 398-0008; www.greatplanes.com.*

Horizon Hobby Inc., *4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; fax (217) 352-0355; www.horizonhobby.com.*

JR; *distributed by Horizon Hobby.*

LustreKote; *distributed by Great Planes.*

Morgan Fuel; *distributed by Horizon Hobby.*

Thunder Tiger; *distributed by Ace Hobby Dist.*

UltraCote; *distributed by Horizon Hobby.*

Hobby Lobby Firecat

by Vic Bunze

SPECIFICATIONS

MODEL: Firecat

DISTRIBUTOR: Hobby Lobby Intl.

TYPE: sport /fun-fly aerobatic electric

WINGSPAN: 34 in.

WING AREA: 360 sq. in.

READY-TO-FLY WEIGHT: 32 oz.

WING LOADING: 12.8 oz./sq. ft.

LENGTH: 34 in.

RADIO REQ'D: 4-channel w/5 servos (elevator, rudder, throttle, ailerons)

RADIO USED: JR 10X transmitter, a JR R600 receiver w/5 Hitec HS-60 servos and a Jeti JES30-3P ESC

MOTOR REQ'D: Speed 500 or Jeti Phasor 15/4 brushless

MOTOR USED: Jeti Phasor 15/4 brushless

BATTERY USED: 7-cell, 2000mAh Ni-Cd

PROP: Graupner 10x4 Super

PRICE: $159

FEATURES: built up of balsa and ply; covered in transparent Mylar film; landing gear, wheels, plastic cowl, pre-trimmed canopy and all of the necessary hardware are included.

COMMENTS: the Firecat performs like a glow-powered aerobat with the quiet, no-mess convenience of an electric airplane. I have flown my Firecat from a baseball field, and though it's a bit fast for a park flyer, it definitely doesn't require a full flying field. I enjoy this plane a lot and highly recommend it to anyone looking for an exciting electric aerobatic plane.

HITS

- Excellent workmanship.
- Lightweight construction.
- Easily built.
- Highly maneuverable and aerobatic.

MISSES

- No provisions to hold the wing in place.
- Instructions aren't clear.

Electric aerobat with glow-powered performance

The Hobby Lobby Firecat is a beautiful model with a snappy performance that rivals that of a glow-powered aircraft. It's nicely constructed of balsa and ply, which produces a lightweight, yet sturdy, frame. It also comes expertly covered with a stunning, cherry-red, transparent Mylar film. The Firecat has a pleasing appearance with generous control surfaces for the dual-aileron servos and rear-mounted elevator and rudder servos.

The motor mount comes installed, and the motor is bolted directly on the nose ring with two M3 bolts. The kit also includes landing gear, wheels, a transparent plastic cowl, a trimmed canopy and all of the necessary hardware. You simply supply the radio gear, motor, speed control and battery.

ASSEMBLY

The Firecat is very easy to assemble and prepare for flight; it can be put together in just a few hours. Although the instructions are a bit brief and somewhat loosely translated, assembly should pose little difficulty to an experienced builder.

I started with the wing. Because the hinge slots are precisely cut, hinging the ailerons with the supplied hinges was simple. Next, I installed two Hitec HS-60 servos and attached the control horns to the ailerons. I snaked 12-inch extensions for the aileron servos from the wing center-section cutout to the servo connectors.

A bottom hatch, bolted to ply plates at the leading and trailing edges of the fuselage, secures the wing. This hatch covers the wing's entire underside at the fuselage junction and completes the wing's fairing to the fuselage. It also allows access to the battery pack, which is installed in the wing's center cutout section. The battery pack can be slid forward and backward to adjust the center of gravity (CG). Once the CG was determined, I used foam blocks to fix the forward/aft location of the battery in its channel.

There is no provision to lock the wing in to place along the span axis. The wing is free to shift sideways, and consequently, the ailerons could bind against the side of the fuselage. To prevent this, I added a simple dowel key at the wing's leading edge and drilled a corresponding ¼-inch hole in the forward fuselage bulkhead. I also added two ⅛-inch dowels to the wing's trailing edge to hold it in place.

PHOTOS BY VIC BUNCE & WALTER SIDAS

FLIGHT PERFORMANCE

The Firecat was certainly designed with flight performance in mind. It leaps off the ground and easily takes off from grass. It is very maneuverable, has a wide speed range and nearly unlimited vertical performance and easily slows down for landing.

For aerobatic maneuvers, the Firecat should be flown at full throttle; though it flies nicely at ½ throttle, its vertical performance is greatly reduced. Because of its light construction, the Firecat can handle a 7-cell, 2000mAh Ni-Cd pack and will provide more than 4 minutes of full-throttle flight. If you manage the throttle, only pushing it to full for vertical performance, the Firecat's flight duration can be extended to 7 or 8 minutes.

TAKEOFF AND LANDING

The Firecat accelerates rapidly on application of the throttle. A nudge of right rudder keeps it on track, and once up to flight speed, it smoothly lifts off with just a little pressure on the elevator stick. I needed very little trim correction on the initial flight, which indicated that the recommended setup was right on the money. The Firecat slows nicely for landing and is easy to control at slow speed. Approaches should be made at 40-percent throttle, and once the plane has made the field threshold, throttle can gradually be reduced.

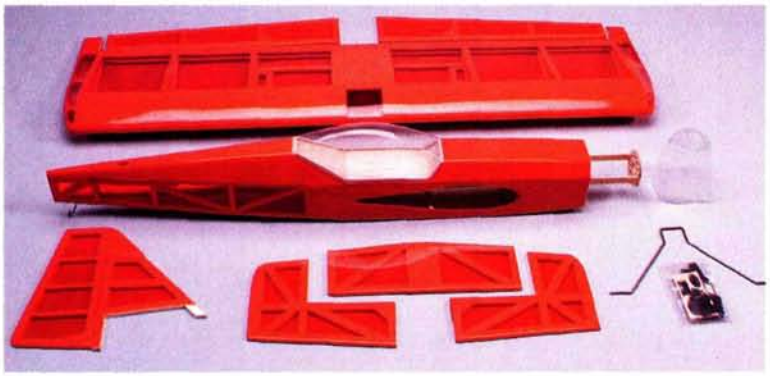
LOW-SPEED PERFORMANCE

The low wing loading of the Firecat allows for excellent slow-speed control. Stalls are manageable, and there's no tendency to snap or drop a wing.

HIGH-SPEED PERFORMANCE AND AEROBATICS

The recommended 10x4 prop works well, and at 9,700rpm, it provides a top speed of about 45mph.

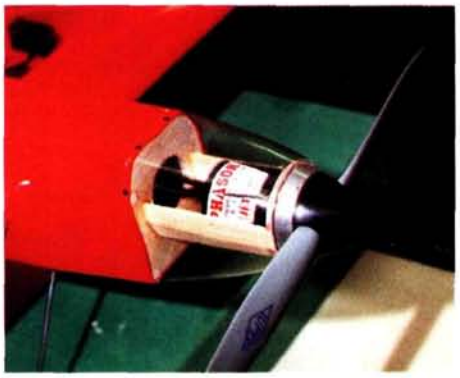
The Firecat was designed for aerobatics. It can easily do all of the standard maneuvers one would expect from a sport/aerobatic plane. It's very responsive to the controls, and set on high rates, it's capable of extremely fast axial rolls. The Firecat can do both large sweeping loops and very tight ones, particularly when you couple elevator into flaperon. With slight forward pressure on the elevator, inverted performance is smooth.



The Firecat comes with everything you see here, plus all of the necessary hardware. Simply add a motor, battery and radio gear, and you're in for some exciting flights.

The Firecat comes with a lite-ply mounting plate to mount the tail-group servos in the rear of the fuselage. I cut away the covering material over the fuselage section that was to receive the mounting plate and used the excess material to cover it. Then I cemented the plate into place, flush with the fuselage sides. This arrangement provides very short and positive pushrod connections. I connected the rear servos to the receiver with 12-inch servo extensions.

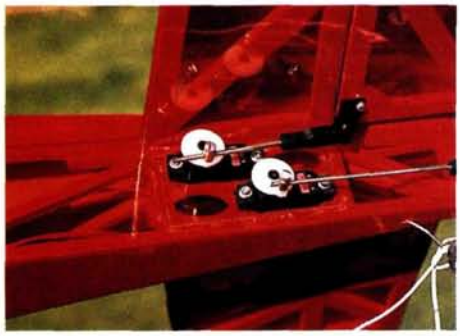
The next step is to join the elevator halves with a U-shape joiner wire; the ends of the halves contain brass tubes to mate with the vertical arms of the "U." Insert the wire into the elevator slot on the fuselage, then insert the horizontal stabilizer into the slot and mate it with the brass-tube bearing on the base of the wire. This assembly goes together quickly and fits perfectly. Bolt the control horns onto the elevator halves with ½-inch, 2-56 socket-head bolts. The installation of the hinges and fitting of the control rods is fairly straightforward and should go easily.



Above: because the mount comes attached to the fuselage, installing the motor is simple. I mounted the Jeti Phasor 15/4 motor on the nose ring with two M3 bolts. Right: though not mentioned in the instructions, I added these small dowels to secure the wing. Notice the center-wing cutout for the battery; it's roomy enough to slide the battery back and forth to adjust the center of gravity.

I mounted the recommended Jeti Phasor 15/4 brushless motor to the nose ring with two M3 bolts. The motor has three connectors that plug into the three connectors of the ESC. I used Deans Ultra plugs; these connect the battery to the ESC. The order is not important, but if the motor runs backwards, any two of the three wires should be reversed. The ESC and the battery's tail are in the fuselage's front compartment—just behind the firewall. Mount the on/off switch on the front side of the fuselage in the hatch compartment; simply remove the balsa hatch cover to access this compartment.

I used a mixture of alcohol and Elmer's white glue to apply black tissue to the cockpit area. I then glued the canopy into place with RC-56 adhesive and trimmed the edges with red plastic adhesive tape. The canopy fits perfectly.



The lite-ply mounting plate for the tail-group servos is a nice touch. This arrangement allows very short and positive pushrod connections.

FLIGHT PREPARATION

I set the throws using four flight modes on the JR 10X transmitter. The first mode used conservative throws on all of the control surfaces; the second mode was a more aggressive setup; the third mode consisted of more extreme throws, and the fourth mode permits the coupling of ailerons (as flaps) with elevator throws to achieve a very tight radius on inside and outside loops.

I like to run a few discharge cycles through the battery pack/ESC/motor combination on the ground before putting any plane in the air. I use a full range of throttle settings to make sure that there is no control interference and to get an idea of how the components will behave when warmed up. Listen carefully for any motor cutouts and watch closely for control jitter. This also serves as a good opportunity to do a range check.

CONCLUSION

The Firecat is the perfect airplane for the electric flier who wants a model that will perform like a sport, glow-powered aerobat. It's very easy to assemble and a joy to fly. It has pleasing lines and almost pylon-racer looks, except for the generous control surfaces and relatively thick airfoil. Even with the wing on, it takes up very little room in the car, so it's a good choice to throw into the back seat for those impromptu flights. ✈

***Hitec RCD Inc.**, 12115 Paine St., Poway, CA 92064; (858) 748-8440; fax (858) 748-1767; www.hitecrcd.com.*

***Hobby Lobby Intl.**, 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948; www.hobby-lobby.com.*

***Jeti;** distributed by Hobby Lobby Intl.*

***JR;** distributed by Horizon Hobby Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; www.horizonhobby.com.*

***W.S. Deans Co.**, 7628 Jackson St., Paramount, CA 90723; (562) 634-9401; www.wsdeans.com.*

COOL IT!

by Dave Gierke

All engines, whether they're in your RC airplane or the car parked in your garage, produce heat as they run and operate best at a certain temperature; but too high a temperature is detrimental to performance and, if left unchecked, can lead to engine failure. Many factors affect cooling in ABC engines (and with it, engine performance), and you can adjust or change them. We'll consider most of them here, but let's first look at what happens when cooling isn't controlled.

Not just for burning

How fuel cools

A 2-stroke RC engine is partially liquid-cooled by its fuel. Lubricating oil also helps cool the engine. Here's how:

›› METHYL ALCOHOL (methanol): the methanol in the fuel enters the crankcase in liquid droplet form and is heated by conduction. Conduction takes place when materials (solid, liquid, or gas) that have different temperatures are in contact with one another. Heat always flows from the hotter material (the engine parts) to the cooler substance (the liquid fuel). As the methanol reaches its boiling point (147 degrees F), it vaporizes and mixes thoroughly with inducted air molecules. This change-of-state process, called "latent heat of vaporization," consumes great quantities of heat and is especially effective in cooling the piston, wristpin and upper connecting-rod bushing. As the air/fuel mixture is transported through the bypass channels and cylinder transfer ports, additional evaporative cooling takes place.

›› FUEL OIL: all RC fuel mixtures contain oil to lubricate and cool the engine. To be successful, the lubricant must effectively wet moving surfaces while resisting surface boiling and vaporization. Two types of oil are typically used: castor and synthetic.

›› CASTOR OIL: this lubricates and cools well beyond the temperatures at which most synthetics can function. As temperature increases, castor oil becomes thermally unstable and rapidly polymerizes (a chemical reaction in which two or more small molecules combine to form larger molecules), becoming a better lubricant while consistently carrying away waste engine heat through the exhaust system. Some enthusiasts consider castor oil a nuisance, since it decomposes into a soft varnish that must be removed from internal and external engine components from time to time.

›› SYNTHETIC OIL: synthetic lubes are excellent but can also have limitations in the presence of overheating. Most can burn in the combustion chamber if the needle valve is set too lean; they can also boil on the cylinder walls, piston skirt and wristpin areas. Under extreme temperatures, they can degrade into the materials from which they were formulated, and these are generally less suitable lubricants.

TEMPERATURE TUNING FOR MAXIMUM ENGINE PERFORMANCE

SOME (DON'T) LIKE IT HOT

When excess combustion heat doesn't dissipate fast enough, engine temperature soars. Today's ABC components (aluminum piston, brass cylinder, chrome-plating) have closely matched expansion rates; this allows them to operate at temperatures well in excess of any other combination of metals without seizing. The piston is in direct contact with hot combustion gases, however, and it has no efficient heat-dissipation path, so its cooling is dependent on other events and circumstances. In extreme cases, the best silicon aluminum-alloy pistons will melt if temperature is allowed to climb unabated. Known by racers as "burning a piston," the phenomenon may be more accurately described as a blowhole through the crown.

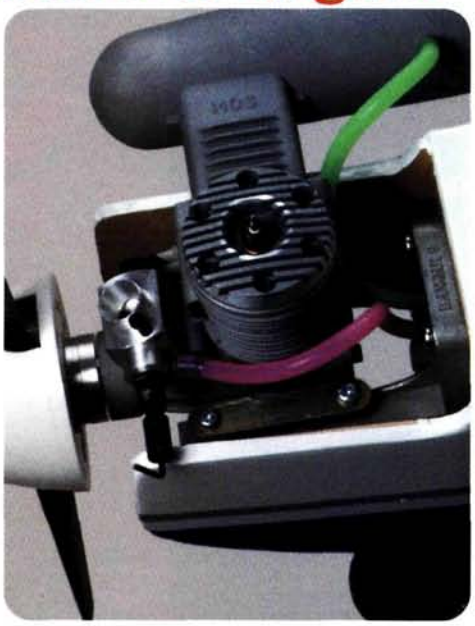
The piston isn't the only component that suffers; the wristpin and the upper portion of the connecting rod that operates within these furnace-like conditions are prime candidates for temperature-related failure. Many 2-stroke engines fail because the rod bushing seizes on the crankpin as a result of overheating. That takes care of the "worst-case" scenario; now let's look at how we can avoid it!

If your engine runs too hot, the piston might burn through. The piston on the left has a small depression while the one on the right has been burnt right through its center.

Head temperature & engine cooling

The most accurate place to measure an engine's temperature is on the cylinder head near the glow-plug opening, or better, on the glow plug itself. The temperature reading at this location is a good indicator of engine cooling but a poor gauge of a correct or optimal air/fuel mixture.

A general temperature range of between 350 and 375 degrees Fahrenheit (F) is a safe bet for most applications. I've seen ABC engines run perfectly at 400 degrees F (which is about as hot as I want to run an engine). This is usually an example of a correct needle-valve setting with marginal cooling. I've also seen engines self-destruct operating at below 300 degrees F; this is usually an instance of overcooling with a lean needle-valve setting, and that combination limits oiling to critical engine components.



To maximize its performance, your engine should be run at between 350 and 375 degrees, and temperature is most accurately measured on the glow plug or near the glow plug opening at the top center of the head.

Even though an engine is running "cool," it isn't necessarily running right. If extracting the optimal torque and horsepower from a particular setup is the objective, higher cylinder-head temperatures are desired from a slightly rich primary-needle-valve setting. But keep in mind that every combination of engine design, fuel, compression ratio, glow plug, propeller, forced convective cooling and other considerations will modify the ideal temperature.

HOT ADVICE

Causes of overheating

- **The engine is being operated leaner than the "peak power air/fuel ratio" for a given fuel.**
- **The propeller is mismatched and does not allow the engine to rev up to an appropriate rpm.**
- **The piston/sleeve combination is worn out.**

To avoid heating problems ...

- **Set the engine slighly rich when you achieve maximum power.**
- **Use 18 to 22 percent lubricant and add castor oil to the mix.**
- **Don't change the nitro percentage.**

Solutions to heating problems

- **Detonation, caused by an overheated, over-compressed air/fuel mixture, can be fought by shimming the head to reduce compression and/or by switching from a hot to a cold glow plug.**
- **If head temperatures rise above 400 degrees, increase the airflow over the head, and reduce compression by shimming.**

Nitro facts

Nitromethane produces more energy per cycle, combustion-chamber pressure and crankshaft torque than any other common fuel component. Combusting nitro also adds excess heat.

Nitro isn't without its problems: burning it produces sharply elevated combustion temperatures that encourage detonation—especially with higher percentages of nitro mixed in the fuel. If you raise the nitro level, you should also consider shimming the head to reduce the compression ratio.

ILLUSTRATION BY DAVID BAKER

As a general rule, using a mixture of synthetic and castor lubricants can optimize engine performance. A good starting point is 20 percent lube by volume. I particularly recommend the addition of castor oil to the lubrication package when you're dealing with the higher cooling loads and heavier wristpin pressures encountered with high-performance engines.

If you currently use an 18 percent straight synthetic fuel, try adding some castor oil. You can obtain Bakers AA or Klotz Bean oil from your local hobby or motorcycle shop. If the hobby shop doesn't carry castor oil, it can get it from a distributor.

I suggest that for our applications, a mixture of one part castor oil and two parts synthetic is an effective combination.

Mixing your own

This formula tells you exactly how much castor oil to add to your fuel blend:

$$\text{Oz. to add} = \frac{(F - I) \times A}{100 - F}$$

F = final percentage of oil desired

I = initial percentage of oil already in the fuel

A = number of ounces of fuel you are treating

EXAMPLE: if you have a gallon (128 ounces) of 18-percent-synthetic-oil fuel and you want to add castor oil to bring it up to 20 percent, find the following:

F = 20
I = 18
F - I = 2

$$\frac{(20 - 18) \times 128}{100 - 20} = 3.2$$

So, add 3.2 ounces of castor oil to the gallon of 18-percent-synthetic-oil fuel. Be aware that since the new volume is larger than the original gallon (now 131.2 ounces), the actual percentage of nitromethane and methanol will be decreased slightly but not enough to affect performance.

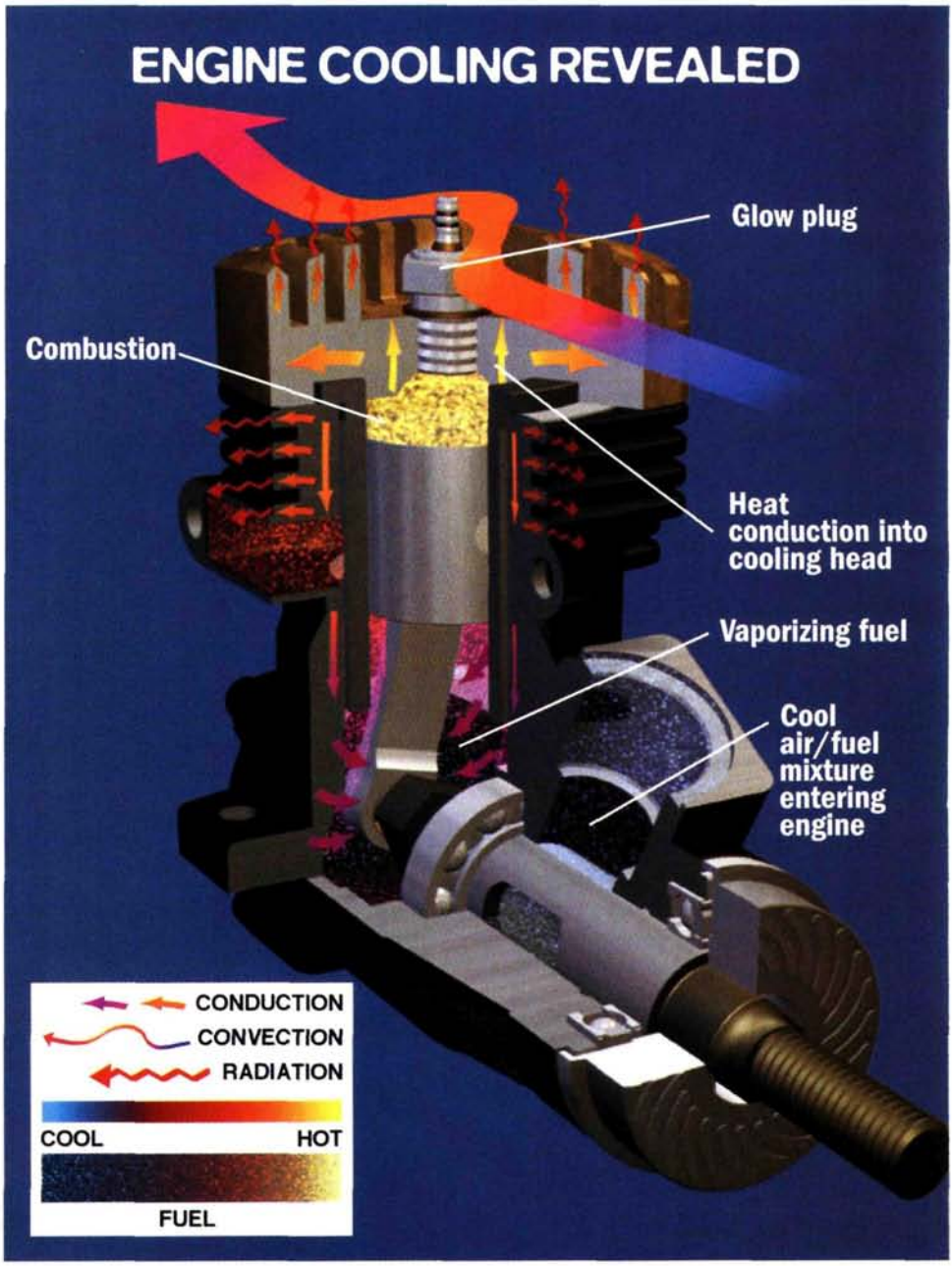
How to measure head temperature

There are two common ways to accurately measure cylinder-head temperature: use an onboard sensor or an infrared temperature gauge.

›› **Onboard systems.** The units offered by MIP and Traxxas, two prominent RC car manufacturers, are very convenient and affordable, and they sense engine temperature via bi-metallic thermocouple sensor wires. Onboard units work well for relative temperature comparisons but do not measure actual temperature very accurately because the thermocouple wires are difficult to secure closely to the glow plug.

›› **Infrared temperature gauges.** Hand-held infrared units, usually referred to as "temp guns," are more accurate because they can be aimed precisely to zero in on the glow plug. Some use laser sighting devices; others use tapered cones around the sensor tip; both methods work well.

Left: there are two ways to measure an engine's temperature accurately: with an onboard temp gauge (see the small, light MIP gauge on the right of the photo) and with an infrared sensor (the Raytek "gun" on the left).



EXPLOSIVE results of high temperatures

High combustion-chamber temperatures produced by lean air/fuel mixtures often promote combustion defects such as pre-ignition and detonation. These can adversely affect performance and damage the engine.

Pre-ignition

If a portion of the combustion chamber such as a sharp edge from a tapped glow-plug hole or a carbon particle becomes overheated under operating conditions, it's possible to pre-ignite the fresh combustible charge. This potentially damaging early ignition isn't desirable because of erratic and uncontrollable combustion accompanied by soaring temperatures.

Detonation

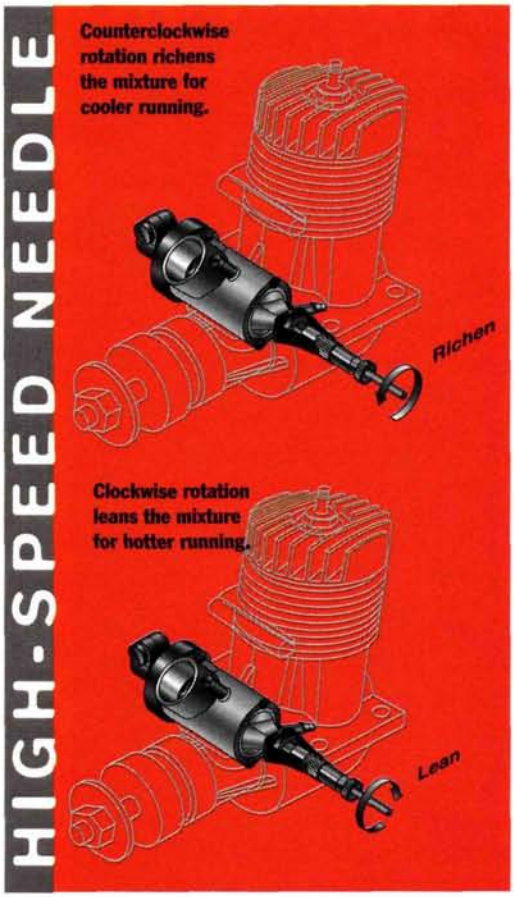
Detonation is a major factor that causes designers to limit the compression ratio in any internal-combustion engine. Violent pressure fluctuations accompanying detonation can cause severe mechanical engine damage. Unlike pre-ignition, which occurs before combustion, detonation happens after burning has started. As the normal flame front is progressing across the combustion chamber, the unburned mixture is being compressed. If this mixture reaches its auto-ignition temperature, it will ignite, causing two colliding pressure fronts; detonation is the result.

Needle-valve setting for maximum performance —and best cooling

For any phase of engine operation (idling, transition or wide open throttle), fuel must be added to the available air in the correct proportion (the "air/fuel ratio"), or the combustion process, torque and power will degrade. While extremely rich needle-valve settings should be avoided with ABC-type engines owing to piston-wear considerations, extremely lean runs will cause the engine to overheat and will severely damage it in the process.

It's important that you never operate an engine leaner than the peak power air/fuel ratio for a given fuel. This is the needle-valve setting at which maximum rpm is obtained for any given load. Practical experience has shown that a slightly richer than peak setting will act as insurance against a lean, hot, damaging run.

Some guys insist on adjusting the needle valve to its leanest position in an attempt to squeeze the highest rpm and performance from their engines. This is asking for trouble. The engine may be a click away from disastrous, high-temperature operation. Lean mixtures also promote combustion defects such as pre-ignition and detonation; these add to the engine's already burdensome cooling load. Rich, relatively cool operation reduces the possibility of these problems. Engines can be set noticeably rich and still produce nearly maximum power without fear of temperature-related damage.



Inside the main, or high-speed, mixture needle: turn the needle counterclockwise to let more fuel enter the carburetor; turn it clockwise, and it lets in less fuel. Top: more fuel (richer) means an engine that runs cooler. Bottom: less fuel (leaner) means an engine that runs hotter.

You'll note that the many available glow plugs are listed as having a variety of heat ranges. You can fine-tune your engine just by changing its glow plug.

When to change from a HOT to a COLD plug

By selecting the correct glow-plug heat range, the engine's cooling load may be reduced for a given fuel blend and compression ratio. Here's how it works:

Glow plugs have platinum-rhodium- or platinum-iridium-alloy wire coils (elements) that heat up and glow orange to orange/white when a low-voltage direct current is passed through them. When the engine is running and the current has been disconnected, the coil continues to glow. This is the result of an exothermic (heat-releasing) catalytic reaction between the platinum-alloy coil and the fuel's methanol, plus heat absorbed during combustion.

A "hot" plug retains much of its heat from the previous cycle and helps to ignite the fresh air/fuel mixture during the early part of the compression stroke. A "cold" plug carries less heat from the previous cycle and therefore ignites the air/fuel mixture later in the compression stroke.

By changing from a hot plug to a cold plug, an experienced tuner can retard the ignition point (ignite the air/fuel charge closer to top dead center) and quench a detonation or pre-ignition problem that is sapping power and forcing extra heat into the cooling system without having to reduce the compression ratio. Sometimes, a combination of changing the heat range and the compression ratio works best to restore power and lower the cooling load.

Engine Condition and Load

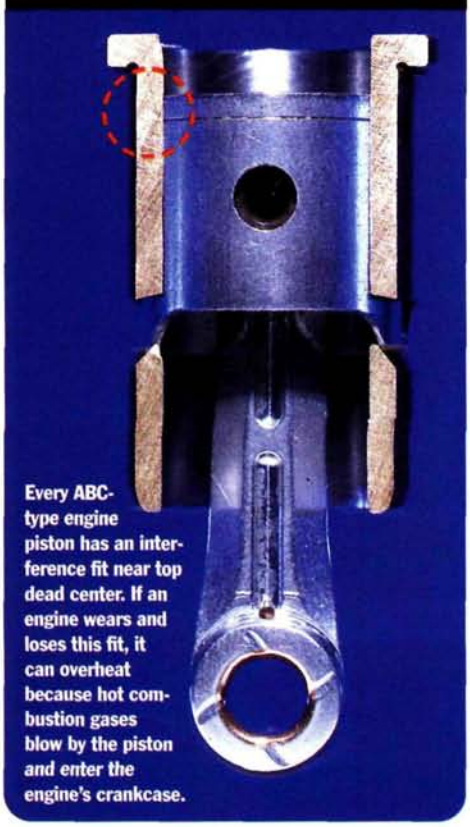
If the piston/cylinder combination is worn out, the engine will overheat. When the ABC-type piston loses its "pinch" (interference fit) near top dead center (TDC), it's a sign that clearances between the piston and cylinder are becoming excessive. When operating at temperature, hot combustion gases will blow by the piston and into the crankcase, increasing friction and adding more heat. The piston can't efficiently transfer heat to the cylinder walls, and hot spots promote pre-ignition.

As head temperatures rise, the cooling system will appear to be overloaded. When any of a number of corrective actions are taken, the engine will lose power. It's time to purchase a new piston, cylinder, connecting rod and wristpin set!

Engine load

An engine that is overloaded with too much propeller (diameter and/or pitch) will often overheat at prolonged wide open throttle (WOT) operation.

Rather than changing the glow plug, compression ratio, air/fuel mixture, or other factors, the best solution may be to change to a prop with a smaller diameter and/or pitch that will allow the engine to speed up.



Every ABC-type engine piston has an interference fit near top dead center. If an engine wears and loses this fit, it can overheat because hot combustion gases blow by the piston and enter the engine's crankcase.

The BIG squeeze

Compression ratio and cooling

When a fresh air/fuel mixture is squeezed in the combustion chamber by the piston, it is said to be compressed. The amount of compression is determined by comparing the volume before and after compression—hence the term "compression ratio."

As the compression ratio increases, so does the pressure in the combustion chamber. Along with the pressure, temperature also increases. High-compression-ratio engines exert more force on the piston; they produce greater torque and power at the crankshaft than low-compression engines. They also generate higher temperatures in the combustion chamber, and these must be dissipated, partially by the engine's cooling system.

WHEN TO ADD A GASKET

Since higher compression ratios mean greater engine performance, why would anyone knowingly lower the compression by adding a gasket (a shim)? The answer is to control the engine's internal temperatures. When a gasket is added between the top of the cylinder and the bottom of the head, the engine's compression ratio and cooling load are reduced.

If you have an over-compressed engine, its sound will likely tell you that something needs immediate attention. Over-compressed engines are prone to pre-ignition and detonation. It's difficult to identify which defect is present because they sound alike (the sizzle of a frying egg or a sharp crackling sound from the exhaust during operation). Detonation sometimes produces a metallic pinging sound, but this is usually reserved for larger-displacement engines.

Signs of pre-ignition or detonation damage can be found on the engine's piston crown and cylinder head. If otherwise shiny aluminum components look sand-blasted, you have a combustion-defect problem.

The number-one solution to eliminating either of these problems is to reduce the compression ratio: add a head gasket. Engine manufacturers sometimes include an extra head shim in the 0.004 to 0.008-inch thickness range. Don't be afraid to experiment with compression ratios, but listen for the telltale frying egg sound, and carefully monitor the head temperature.

WHEN TO INCREASE AIRFLOW

If you have a high-compression engine that runs strongly at the correct needle-valve setting, you want to maintain this performance. But if the head temperature continues to rise (say, above 375 degrees F), you need to decrease the temperature, or chances are good that something will fail. Your best bet is to increase the airflow over the existing fins. Resist reducing the nitro content to lower the temperature, as this will change the expansion rates of the piston and cylinder. That can affect their fit, cause friction and reduce performance and even damage your engine.

WHAT ABOUT COWLS?

The only engine parts that require cooling are the cylinder and the head—from the bottom of the exhaust stack up. (The crankcase operates at a lower temperature owing to fuel vaporization, which draws most of the heat from that area.) On a .40 sport-model engine, the cowl's air-inlet hole doesn't have to be very large, but it should direct the air onto the front of the cylinder, particularly the cylinder head because convection and radiation direct most of the waste heat there. How big should the hole be?—½ inch wide by 2 inches high should suffice. Equally important is the exit hole; if you don't provide one, airflow over the engine will be reduced greatly. The rule is that you should make the exit hole at least 1½ times the size of the inlet hole.

The 10hp .40!

If .40 engines were perfectly efficient, they would produce an amazing 10hp! Why? Only about 20 percent of the fuel's energy is converted into work. Here's where the other 80 percent goes:

- **40 percent of the energy is blown out though the exhaust in the form of waste gases and unburned fuel.**
- **10 percent is "ground away" by friction within the engine.**
- **30 percent of the fuel's energy is shed in the form of heat.**

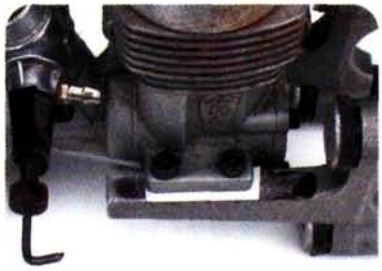
Too much cooling

A cold running engine—one that operates at below 300 degrees F (head temperature)—is inefficient because it wastes fuel. More important: a cold running engine isn't nearly as powerful as it could be. Although such an engine is often free of pre-ignition and detonation, it's likely to display power-robbing, erratic pressure pulses from cycle to cycle. Fuel vaporization in the crankcase suffers from lack of heat, and that compounds the problem. A suggestion: run your engine safely on the cool side—less than 400 degrees F but above 350 degrees F.

Heat-sink engine mounts

Under normal operating conditions, a methanol-burning 2-stroke engine should be cooled from the bottom of the exhaust manifold to the top of its finned heat-sink head. Although some may disagree, I recommend that nothing below the exhaust manifold be cooled because a substantial amount of the heat being conducted to the lower block can be diverted to the atmosphere rather than into the crankcase. This retards fuel vaporization. When unvaporized fuel droplets enter the combustion chamber, they are poorly mixed with the available air and burn erratically, if at all, before being scavenged (cleared) from the engine.

To prevent this type of unwanted cooling, I do not recommend the use of heat-sink engine mounts. Some experts even believe that conventional metal engine mounts should be thermally insulated from the engine. This can be accomplished by inserting a piece of 1/64-inch plywood or card stock between the mounts and the engine-mounting flanges.



There is no need to drain heat from an engine's crankcase area. Put a thin piece of plywood or card stock between the engine block and the engine mounts to reduce cooling in this area.

How much lubrication is enough?

Experienced modelers know that using lower percentages of lubricant in the fuel blend—14 to 16 percent—will allow their engines to develop more torque and horsepower. It will also provide a crisp throttle-up.

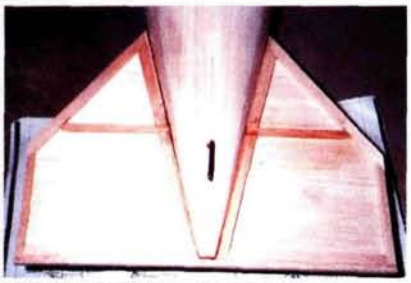
For Sunday fliers, this can be a dangerous tactic. If the engine begins to run hot, the lubricant will have difficulty wetting the metal surfaces while trying to absorb additional excess heat. Lean oil percentages are often spread too thinly and boil off hot cylinder walls, piston skirts and wristpins.

The best strategy is to use a higher percentage of lubricant (minimum 18 to 20 percent) in the fuel. The difference in peak power and throttleability is hardly noticeable.

High cooling loads result when increased engine temperatures must be controlled by the cooling system.

An unusual WW I fighter with award-winning performance

I have always wanted to build WW I aircraft other than the more commonly seen Fokkers, SE5s and Camels. When I discovered the Siemens Schuckert D-III, I knew I had found my next project. There are many color schemes available, and I highly recommend Bob Pearson, or the Windsocks Data Files, for ideas. The model is challenging to build but involves nothing that the average modeler can't tackle with a little patience and persistence. It has no bad flying habits and is accurate enough in outline to be competitive in scale competition. I have won the Westchester Radio Aero Modelers show WW I class, and I took first place at the Farmington, CT, scale meet and a first place in Expert class at the New England Scale Championships. Let's start building!



Start construction with the tail surfaces. Here, the horizontal stab has been attached to the fuselage. Note that the one-piece center spar goes through the fuselage.

TAIL CONSTRUCTION

Begin with the horizontal stab; it's fairly simple to build. Build the stab over the ¼-inch-square spruce center spar placed on the plan, but don't glue it to the spar until you have inserted it

Siemens Sch

by David Johnson

SPECIFICATIONS

NAME: Siemens Schuckert D-III

TYPE: ¼-scale WW I fighter biplane

WINGSPANS: 81.5 in. top, 74 in. bottom

LENGTH: 55 in.

WING AREA: 1,911.56 sq. in. (8.27 sq. ft.)

WEIGHT: 15 to 18 lb. (15.5 lb. prototype)

WING LOADING: 29.02 to 34.80 oz./sq. ft.

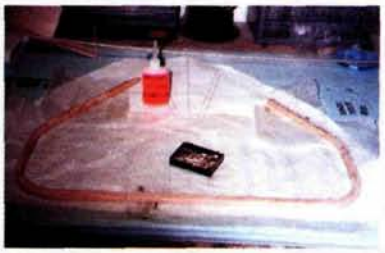
ENGINE RANGE: 25 to 40cc 2-stroke, or 1.20 to 1.50 4-stroke

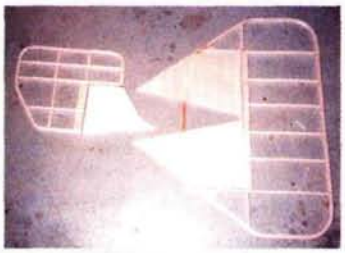
ENGINE USED: Brison 40cc

RADIO REQ'D: 4 channels (rudder, ailerons, throttle, elevator)

PROP USED: homemade 4-blade

COMMENTS: designed by David Johnson, the Siemens Schuckert D-III is a seldom modeled WW I fighter that is a dream to fly. Using traditional balsa and plywood construction, the model has an under-cambered airfoil, four ailerons and a fully sheeted circular fuselage that looks great stained. The model has won several scale contests and earned David an invitation to the 2002 Top Gun Scale invitational in Lakeland, FL.





Far left: the elevator outline is a balsa-sheet lamination. Use pins to hold the part in place while the glue dries. Left: the finished tail surfaces; the fin and stab are fully sheeted.

through the fuselage. Use ¼x⅜-inch-balsa to build the stab outline around the spar, taking great care to not glue it to the spar. Add the ¼-inch-square crosspieces, then sheet the top of the halves (joined by the trailing edge) with 3/32-inch balsa. Add the bottom sheeting after you have attached the stab to the fuselage.

• **Elevator.** Begin by stripping six pieces of 1/16x⅜x48-inch balsa to form the laminated outline. These strips should be soaked in water for about two hours. While they're soaking, stick pins every ¼ inch along the *inner* surface of the elevator's outline. Remove the strips from the water, coat them with carpenter's glue, and make a ⅜-inch-thick, 6-ply lamination. Beginning at one end,

FLYING THE D-III

Even though the control surfaces look huge, set the control throws to the maximum limits. On the elevator, I use 2 inches up and down (4 inches total), 40 degrees of travel in both directions on the rudder, and all the travel I can get without binding on the ailerons. Don't use less!

My first flight was on a cool spring day with about a 10mph breeze blowing at 45 degrees across the runway. I planned to do a couple of taxiing runs up and down the runway, but the plane broke ground in only 10 feet at ½ throttle. It tracked beautifully hands-off into the wind at a slight climb, but with my initial conservative control settings, I could barely make it turn. Also, with the highly under-cambered scale airfoil, it descended steeply when I cut the throttle; I ran out of elevator on the landing flare. I dialed in more control throw on the ailerons and the elevator, and the plane now flies like a dream!

You can do all the scale WW I maneuvers you like with the D-III. The Brison engine provides plenty of thrust, and you'll find the model very responsive. Videos of my first flights can be viewed at my club's website, www.ncrcc.org.

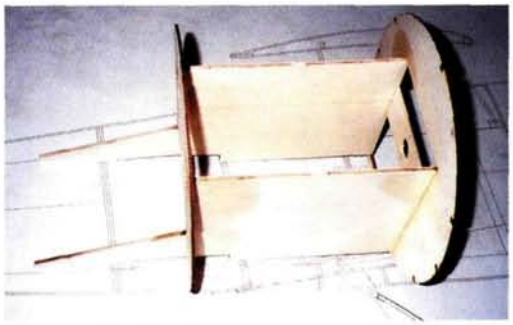
uckert D-III

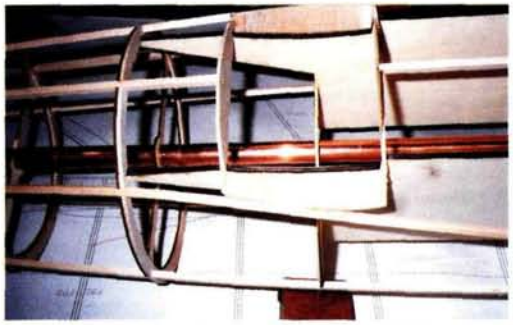
place the lamination (on its edge) about 1 inch past the front of the elevator, and work it around the pins while you place more pins around the outside to hold it tightly in position. Once it's pinned, let the glue dry at least 24 hours. When it's dry, glue the ¼x⅜-inch crosspieces and front and rear supports into place. Add the ⅜-inch-square leading-edge reinforcements, and you have finished.

• **Fin and rudder.** Frame the vertical fin using ¼x⅜-inch balsa, then install the ¼-inch square crosspiece. Sheet both sides with 3/32-inch balsa, and sand the leading edge to shape. Begin the rudder by making six strips for the outline and soak them in water as you did before. Place the pins along the inner surface of the outline every ¼ inch (use ⅛-inch spacing on the tight radiuses). Glue the laminations together as you did for the elevator, work them around the rudder's outline, and pin them into place. Maintain a tight pressure around the corners. After the glue has dried, glue the ¼-inch-square balsa ribs and verticals into place, and then sand the rudder to shape.

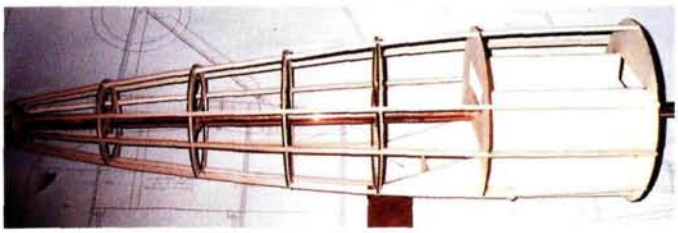
FUSELAGE

Begin the fuselage by constructing the forward fuselage box from parts FP1, FP2, the two ¼-inch lite-ply sides and two 2x5-inch balsa FXX temporary braces. Make sure that the temporary FXX braces are on the centerline as indicated on the plan. Inserted between the box sides at FP1 and FP2, the braces support the front of the fuselage. The circular fuselage formers and the braces have ⅞-inch holes in their centers and are

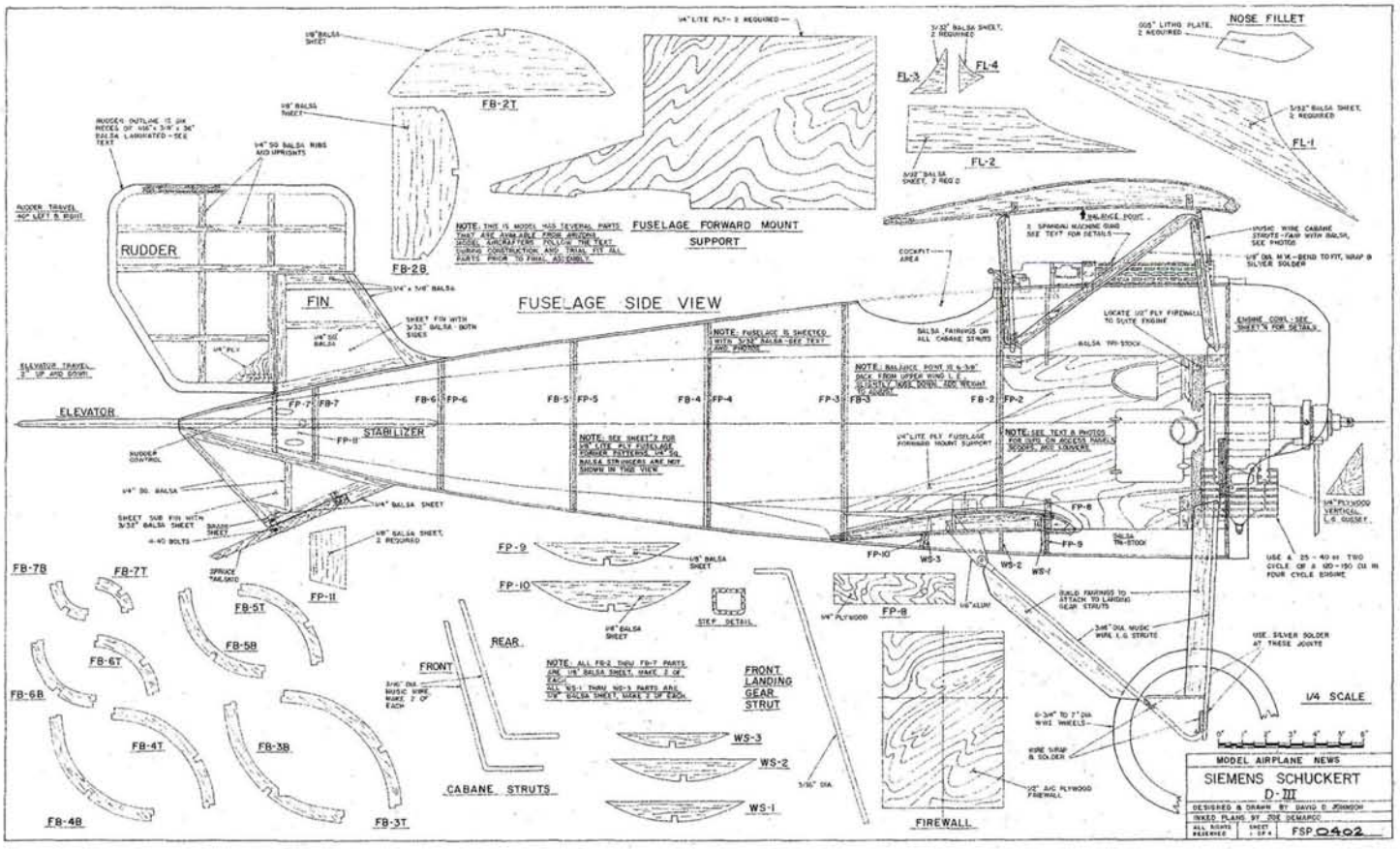




Left: start building the fuselage by assembling the main box structure. Note the temporary brace, FXX, tack-glued inside the box; it holds the structure in alignment on the jig tube. Right: the copper jig tube has been inserted through the circular formers. Below: after sliding the formers onto the tube, add the stringers. Alternate sides to keep the structure straight.



FSP0402 Siemens Schuckert D-III
Designed by award-winning scale designer and competitor David Johnson, the Siemens Schuckert D-III has traditional balsa and plywood construction. The model has an undercambered airfoil, four ailerons and a fully sheeted circular fuselage. Complete construction instructions included with plan. WS: 81.5 in.; L: 55 in.; power: 25 to 40cc 2-stroke, or 1.20 to 1.50 4-stroke; 4 sheets; LD 2. **$24.95**



To order the full-size plan, turn to "RC Store.com" on page 132

The sheeting is being glued to the formers. When all the sheeting except for the bottom is in place, remove the structure from the jig tube.

designed to be slid snugly onto a length of 7/8-inch copper jig tube. Glue the 1/8-inch thick balsa, quarter-round, semicircle formers to the appropriate plywood formers. Each plywood former has two upper and two lower balsa parts. Mark the former locations on the tube, then slide the formers into place. Install the eight 1/4-inch-square balsa stringers in their slots, alternating sides to equalize the stress. Constantly check to be sure that all the formers are perpendicular to the jig tube. Trim the stringers so they form an angled joint at the tail. Using 1/4-inch balsa, reinforce the areas where the horizontal stabilizer's spar will pass through, then cut the openings for the spar in the side stringers.

Sheet the wing saddle using 1/8-inch sheet balsa. The saddle uses FP2 to maintain its correct angle. Complete the saddle construction with scraps of 1/8-inch balsa to tie it into FP9 and FP10; do this on both sides. Cap the grooved-hardwood cabane mounting blocks with 1/8-inch plywood, and place them against formers FP1 and FP2. Mark the outer edges of the formers on the blocks and cut them to size. Epoxy them into place, reinforcing them with 1/2-inch triangle stock. Keep the trimmed-off ends; you will use them as front landing-gear leg-mounting blocks. Mark the positions of the front landing-gear mounts, then epoxy both blocks to the box and FP1 using 30-minute epoxy. Once this has set, epoxy the 1/4-inch-ply reinforcements into place (two per side).

Sheet the sides and fuselage top from the front of the cockpit to the tail, leaving the bottom open for now. A little water and ammonia helps to curl the sheeting to fit the formers. If you want to finish the sheeting with stain, avoid getting glue on the outside of it, as it will give you light spots. After the glue has dried, remove the fuselage from the jig tube. Check that the tail-spar openings are parallel with the wing seat. Do not install the spar at this time.

RUDDER TILLER

I installed the rudder tiller and linkage by holding the fin on the fuselage a little forward of its true location and then drilling a 5/32-inch hole vertically through the top sheeting and out through the bottom. Make sure that the holes are parallel to the fin's trailing edge. Insert short pieces of 1/8-inch-i.d. brass tube through the top and bottom of the fuselage, then slide in a piece of 1/8-inch music wire before you glue the tubes into place, as shown in the fuselage side view. Install the tiller wire from the top through the brass control arm, and solder the arm into place. Now install the rudder pushrod and the guide tubes for the elevator pull/pull controls. When the rudder works satisfactorily, glue 1/4-inch sheeting between the last two formers on both sides of the bottom stringer, and sand it to match the contour of the formers; this provides additional tailskid/fin support. Complete the bottom fuselage sheeting, sand it smooth and install the tail surfaces.

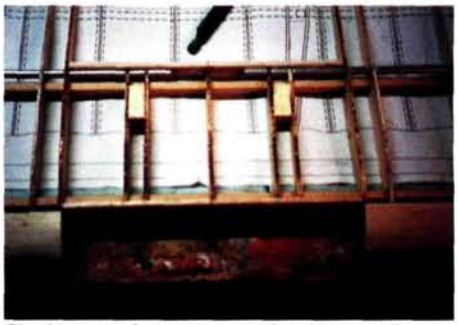
The top wing's center cutout area is also laminated balsa that has been sanded to match the wing's contour.

WING CONSTRUCTION

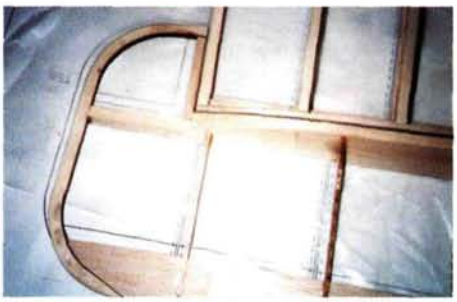
The wings are fairly easy to build, so I'll only describe those areas that require special attention. You can install the aileron servos directly in front of the ailerons, or you can use the scale torque-tube aileron controls shown on the plan. If you use the latter, handle the ribs carefully until you've capstripped the wing. Arizona Model Aircrafters offers laser-cut ribs.

Beginning with the bottom wing, make the 3/8x1/4-inch spruce spars. Block them up 3/8 inch above the plan and install the ribs. Glue the 3/8-inch-square balsa leading edge into place, then install the 1/8x1/4-inch balsa trailing edge and remove the wing from the plan. Cut a piece of 1/8-inch-thick balsa to fit, and glue it into place as the center-section leading edge. Cut to length and install the 9/16x7/16-inch center-section trailing edge, and sand its top edge until the wing fits snugly into the saddle.

The wingtips are made of two 1/8-inch lite-ply pieces laminated together; I bent them to a curved airfoil shape as the glue dried. Now install the 1/4-inch-sheet trailing edge on the aileron cutout area. It should be cut 1/8 inch taller than the rib edge to allow for the capstripping. If you use the aileron torque tubes, install the aileron servo in the wing root area.

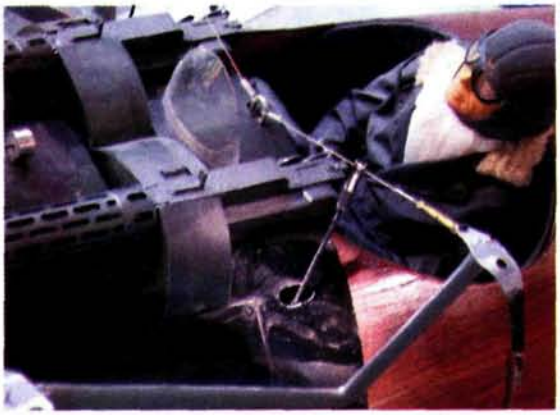


The bottom wing center section. The small blocks support the wing-attachment bolts. Note the aileron torque tube outer sleeves.



The aileron's counterbalance tips are made of two layers of lite-ply glued together.

The top wing is very similar to the bottom. Note: do not install or drill the plywood cabane-strut mounting plates until after you have trial-fit the wing into place! Once you've built the wing, set it on top of the cabane struts with the lower wing installed. The top wing's leading edge should be parallel with the lower wing's. If everything lines up, install the cabane mounting plates above the bottom capstrips as shown on the plan. Mark the locations of the four bolts, install the blind nuts, and bolt the wing into place. Check the wing incidence; the wings should match (plus or minus 1/2 degree). Now use balsa to build up the cabane



Above: the pushrod just ahead of the cockpit connects the aileron servo to the top wing's torque tube. Left: this is the attachment bracket connecting the aileron pushrod and the torque tube.

mounting plates flush with the capstrips. If the wings have different incidences, shim the top wing until it matches the bottom one. When both wings have been set properly, fit the interplane struts into place, but don't drill any holes at this time.

AILERONS

The ailerons are pretty straightforward. Note: a curved gap next to the dog-eared counterbalance extension will need filling. I glued in a piece of ⅛-inch balsa slightly longer than the gap and sanded it flush. Use a piece of ¼-inch scrap to build up the leading edge at the hinge points and do the same where the torque rod enters. When you install the torque rod and the aileron, press the aileron firmly against the rod to leave an imprint; that's where you'll drill the aileron for the threaded rod. The servos for the top ailerons are installed in the fuselage and are connected to the inboard ends of the top torque rods with 2-56 pushrods and clevises.

FIREWALL INSTALLATION

The firewall position will vary according to your engine. Drill the engine-mount holes before you glue the firewall into place. Be sure that there is no interference between the carburetor and the landing-gear mounting blocks. Epoxy the firewall into place, and install triangle stock to strengthen it. Cut away material from F1 until the engine sits flush against the firewall, then use scrap balsa to box in the carb. If you build the later version shown on the plan (with the cut-away cowl), you will have access to the carb for priming and choking. I made my cowl out of fiberglass using blue Dow foamboard, but an aluminum cowl is available from Arizona Model Aircrafters. Use six evenly spaced mounting blocks and screws to install the cowl.

Landing-gear detail. Note the functional bungee shock cords.

FINAL ASSEMBLY AND RIGGING

Chances are really good that when you assemble the model, the wings will be warped; mine were! Brace the wings into their proper positions, and then install the interplane struts and mark the struts through the fittings. Remove the struts, drill the attachment holes and install the 4-40 bolts. When assembled, the wings should not be warped. If there is a bit of droop (anhedral) at the tips, you will be able to correct this with the rigging wires. I used 80-pound test, nylon-coated fishing leader and small-diameter aluminum tubes that I glued and swaged to the wires. Install the landing wires first (cabanes to strut bottoms). This will remove the droop. Once all four landing wires have been installed, add the flying wires (strut top to wing fillet base), and then attach the drag wires (cowl to lower strut).

Finish the model with your favorite products; I used Arizona Model Aircrafters' five-color "lozenge"-pattern printed fabric to cover the wings. Install your fuel tank and any remaining radio components, and attach the spinner (Arizona Model Aircrafters' Albatross spinner is just the right size). The model should balance slightly nose-down at a point 6⅜ inches back from the top wing's leading edge. Add lead ballast until the model balances correctly.

The aft landing gear strut is attached to this aluminum bracket; it's glued into place between two plywood ribs. Note that its angle is established when the gear is screwed into place.

The Siemens Schuckert is the very best flying WW I model I have ever flown, I hope you enjoy yours as much as I enjoy mine. ✈

Arizona Model Aircrafters, 14715 N. 78th Way, Unit 600, Scottsdale, AZ 85260; (480) 348-3733; fax (480) 348-3773; www.arizonamodels.com.

Bob Pearson Documentation, 1332 Summit Ave., Prince Rupert, B.C. V8J3W7 Canada.

Brison Aircraft, 12075 Denton Dr., Ste. 11, Dallas, TX 75234; (972) 241-9152; fax (972) 241-5065.

WW I Documentation Services, Dan-San Abbott, 1800 Stone Cress Ct. Ceres, CA 95307.

Windsock Datafile Siemens Schuckert DIII/DIV, Albatross Publications Ltd.; 10 Long View, Berkhamsted, Herts, England, UK HP4 1B.

THE SIEMENS SCHUCKERT

The Siemens Schuckert was introduced in late spring 1918. The new fighter plane's climb rate and maneuverability were unparalleled, and it was described by many as the ultimate WW I fighter. So why have you never heard of it before? Its chief advantage was also its Achilles' heel. Powered by a revolutionary, 160hp, 11-cylinder Siemens Halske rotary engine, it could maintain high performance at extremely high altitudes owing to its engine's high compression ratio. Also, to minimize engine-torque effects, the engine rotated in a direction opposite that of the propeller. Engine development issues limited the D-III's use to the very end of the War. Even still, aces such as Ernst Udet and Georg von Hantelmann flew the aircraft to good advantage.

PHOTO BY DEBRA SHARP

IMAC Aerobatics—The Figure-9

by Dan Wolanski

The figure-9 is an aerobatic maneuver shaped like the numeral 9. It consists of a straight-line portion connected to a ¾ loop, and it can be entered from a high, low, or mid-level altitude. The maneuver begins to appear in the International Miniature Aerobatic Club (IMAC) Sportsman sequence. Advanced pilots usually execute it in combination with rolling elements at the top of the loop and/or a straight-line segment. Unlimited sequences often include the maneuver with spins, snaps, point and continuous rolls.

FLYING THE FIGURE-9

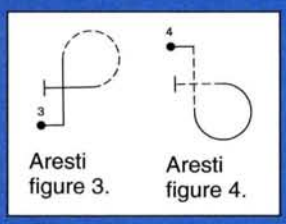
There are two ways to fly the figure-9. The first technique is to fly the straight-line portion first, and then follow with a ¾ loop. This way requires the most power to fly, so don't be surprised to see pilots develop the loop slowly after the straight up-line.

Start the maneuver at full throttle into the wind and begin a vertical climb. Be sure to maintain a straight up-line, as any line deviations will cause the loop portion to corkscrew. Once you have attained a reasonable altitude (at least 300 feet) and are satisfied that you are perfectly vertical, begin to pull back gently on the stick to start the ¾ loop. As soon as you pull, you will immediately notice any deviations created during the vertical portion. Fix any yaw and roll problems using only your rudder. Go easy on rudder, though; you don't want to bleed off too much energy. Also, your initial pull determines your loop radius. Be sure it is not too large, or your maneuver will end up looking like a letter D instead of a 9. Your goal is to split the vertical up-line segment in half as you end the ¾ loop. Continue to pull through the loop using the same technique as you use to fly a loop. Exit the maneuver straight and level and head in the same direction as you entered, only now at a slightly higher altitude.

The second way to fly a figure-9 is by doing the loop first (see Figure 2). This requires much less power than the method shown in Figure 1. Enter the maneuver from about 300 feet going straight into the wind and pull through ¾ loop until the plane is heading straight down. As before, fix any yaw and roll problems with the rudder, and end the maneuver by pulling to straight and level flight in the same direction as you started.

VARIATIONS

The wonderful thing about the figure-9 is its great versatility. You can fly the loop portion by pushing instead of pulling (outside loop on top). This also sends you back in the direction from which you came; in Figure 3 the dashed lines depict negative G. You can also fly the maneuver upside-down (see Figure 4). This configuration is commonly used in Advanced and Unlimited sequences after a spin! The figure-9 can also be used as a cross-box element by adding a ¼, ¾, 1¼, or 1¾ snap or roll when flying the vertical line.



Aresti figure 3. Aresti figure 4.

Hundreds of variations can be created using this very versatile figure. You can increase the level of difficulty by adding snap, point and continuous rolls on the up-line, down-line and looping portions of the figure. Have fun with practicing it, and don't be surprised to see the figure-9 in many of the 2002 IMAC sequences!

FIGURE 1. Flying the figure-9

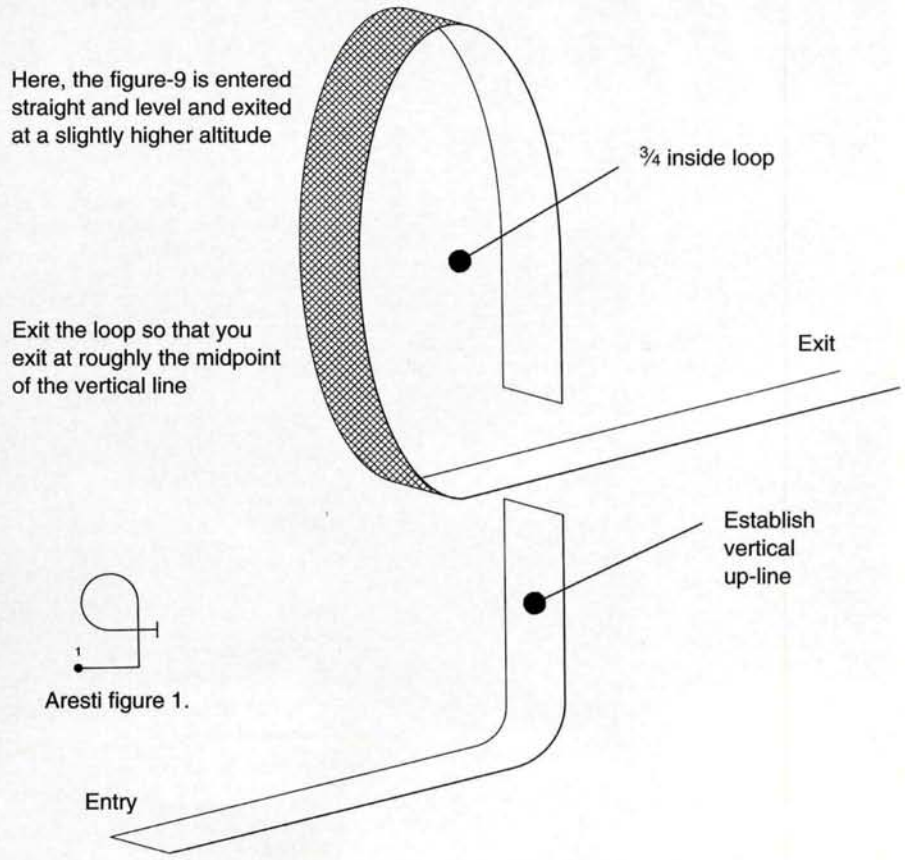
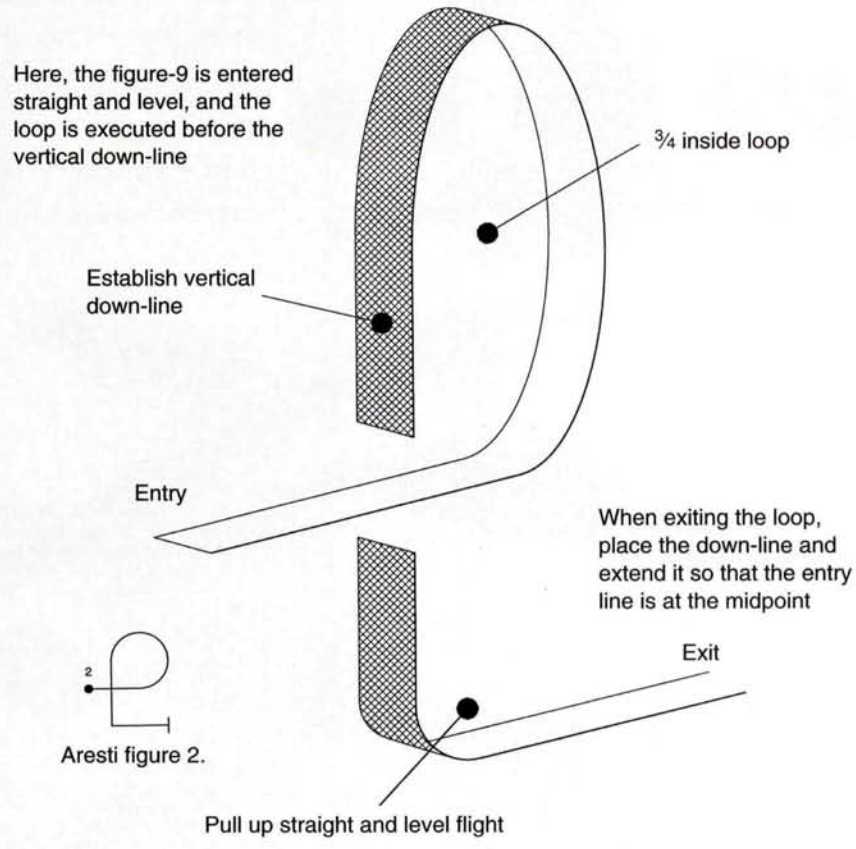


FIGURE 2. Flying the figure-9 variation



FMA DIRECT
T-80RF FM Transmitter
Easy-to-use, all-purpose control

by Bob Aberle

The new FMA Direct T-80RF, 4-channel FM RC transmitter has many attributes, including ease of operation, flexibility and affordability, and its associated systems are perfect for RC beginners and for average sport fliers who are looking for a good second radio. That means that FMA is now a full-system supplier producing transmitters, receivers, servos, battery packs and accessory hardware.

The FMA Direct T-80RF transmitter is available with a variety of system options.

TRANSMITTER

Despite its simple appearance, the T-80RF is microcomputer-controlled, provides four basic channel functions (elevator, aileron, rudder and throttle) and operates on FM (PPM) using any of the 50 RC aircraft channels available on 72 to 73 MHz. Those of you who have been intimidated by computer radios will appreciate the way the T-80RF allows you to achieve extra control functions simply by flipping a series of dipswitches.

There are four servo-reversing switches—one for each channel function— and four additional switches identified as "Mix," "50 percent," "75 percent" and "PPM." For conventional aileron, elevator and rudder control, the Mix switch should remain down; moving it up activates a built-in mixing circuit that combines aileron and elevator for use as elevons (as are needed in a flying wing) and for V-tail aircraft which don't have a traditional rudder.

The appropriate combination of the 50- and 75-percent switches will operate the elevator, aileron and rudder channels at full, 75 percent or 50 percent control. Keep in mind that this function is not selective: it affects all three channels simultaneously. FMA refers to this function as "dual rates," but it isn't the kind of dual-rate operation we're accustomed to. There is no panel switch to allow you to turn the rate control on or off during flight. In effect, this is a form of endpoint adjustment that uses three discrete control positions on every channel function except for throttle. The PPM switch is the most interesting of the four. When it is down, the transmitter can control negative-shift FM receivers such as those made by FMA Direct, Futaba and Hitec RCD. Move the same switch to the up position, and it will broadcast a positive-shift FM signal that operates receivers made by JR and Airtronics/Sanwa. This feature allows you to use any receiver on the market.

For routine functions, the T-80RF has traditional ratchet-type electromechanical trim levers. The two control sticks are relatively short (only 3/4 inch) and they are not adjustable. An attachment is molded into the case front for a neck strap, but none is supplied.

A single LED light indicates the battery's remaining capacity. At full charge, the LED glows green; as the battery is depleted, its color changes to yellow; when the battery is almost dead, the LED is red (do not fly on red). If the batteries die completely, the LED will not glow at all.

SYSTEM OPTIONS

You have a choice between an alkaline battery and a rechargeable Ni-Cd for power. FMA tested a set of 8 AA cells and found that they easily provide up to 10 hours of transmitter operation. If you want to save money, this might be the way to go. If you choose the Ni-Cd-powered system, it will include an appropriate charger. If you purchase the alkalline-battery version and then decide to update to a Ni-Cd, you will have to return the transmitter to FMA Direct. The Ni-Cd pack must be hard-wired owing to the limited available space inside the transmitter.

Because radio needs vary greatly among modelers, FMA Direct offers the T-80RF transmitter by itself, allowing you to choose the system that best suits your needs.

The transmitter is also available with several RC packages that include a variety of components. The first comes with a micro FMA receiver, standard servos, a Ni-Cd receiver battery pack and a 60mA charger.

The second package, designed for small, fuel-powered models, includes an FMA Extreme 5 receiver, two S-80 microservos, a 4-cell, 180mAh Ni-Cd battery pack and a 20mA charger.

SPECIFICATIONS

MODEL: T-80RF RC transmitter

MANUFACTURER: FMA Direct

TYPE: 4-channel, FM

WEIGHT: 22 oz.

PRICES: $79.95 (alkaline-powered transmitter); $89.95 (Ni-Cd-powered transmitter); $99.95 (Ni-Cd-powered transmitter with CM100 or CM200 system charger); system prices range from $139.95 to $154.95.

FEATURES: can operate both negative- and positive-shift receivers; microcomputer-controlled; traditional trims; a single LED light indicates battery capacity; discrete endpoint adjustment of 100, 75 and 50 percent available for the aileron, elevator and rudder channel functions (affects all three simultaneously); built-in mixing circuit for elevon and V-tail controls.

HITS

- Ease of operation.
- Compatible with all receivers.
- Traditional trim levers.
- Excellent instruction manual.
- Variety of options.

MISSES

- Choice of power can be changed only at the factory.
- Endpoint adjustment is not selective.
- Dipswitches aren't clearly identified.

The two sets of tiny switches on the lower front panel are a nice feature. The set on the left controls the mixing option, end-point selection and high/low FM deviation; the set on the right allows servo-reversing on all four channel functions.

The third package was designed for micro electric models and comes with an Extreme micro receiver, S-80 microservos and an FMA SC5 5A ESC with BEC.

FINAL THOUGHTS

Ease of operation is certainly the T-80RF's primary feature. The instruction manual supplied with this transmitter is excellent in every respect. I especially liked the clear sketches that help explain the built-in mixing circuit that allows elevon and V-tail mixing.

That you have to buy only what you need is another plus. You will also find that the prices of the transmitter alone and a complete system are very competitive. The FMA Direct T-80RF is a welcome addition to FMA's line of high-quality RC equipment.

Biplanes—a closer look

To me, the most attractive airplanes are those with a pair of wings. Biplanes, particularly those with round engines, are major icons of classic aviation design. For this column, let's look at some of the things that you should know if you want to build and fly a biplane (these features apply to triplanes as well).

Right: whether on the ground or in the air, biplanes have a lot of "wow" factor. I especially like those with round engines. Below: the new ⅓-scale Great Planes Pitts Special is destined to become a very popular kit.

NEW PITTS ARF

If you have been in the hobby long enough to remember the long-discontinued Byron Originals ⅓-scale Pitts Special, then you'll be very pleased with the new ARF Pitts from Great Planes. Priced at just under $400, this IMAA-legal, almost-ready-to-fly aerobat has a 68-inch span, 1,303 square inches of wing area, and is intended for intermediate to advanced fliers. The kit features pre-covered wings, fuselage and tail surfaces and has painted fiberglass parts. The model is covered in Top Flite MonoKote. Also included are a single-piece, clear-plastic canopy with painted-on frames, prebent landing gear and formed and prepainted struts. Many other hardware items such as the main wheels, tailwheel assembly, fuel tank, engine mount, control horns, nuts, bolts and washers are also included. Engine requirements are either 1.6 to 2.7ci (26 to 45cc) 2-stroke glow or 2.5ci (41cc) or larger gasoline powerplants. All the servos are mounted externally, close to the control surfaces for minimum pushrod lengths.

If the Great Planes Pitts Special flies anywhere near as good as it looks, this promises to be a very popular model for the 2002 flying season. I can't wait to get my hands on one.

The Pitts kit comes with everything you see here. That saves a lot of building time!

WHY USE TWO WINGS?

When biplanes were first invented, two wings were used more for strength than for any aerodynamic reason. Even though a biplane has twice as much lift-generating surface as a monoplane of the same span, it carries with it a big increase in drag. Using two wings, however, gives aircraft designers an excellent format in which to produce very strong structures. This is because struts, rigging and flying wires support and tie the two wings together, much as girders and beams strengthen a truss bridge. As lighter and more powerful engines became available, the increased drag became less of an issue. Today, in world-class-unlimited aerobatics, biplanes such as the Pitts Special remain very popular. The biplane's strength and relatively short wingspan enable pilots such as Sean D. Tucker, Jimmy Franklin and Gene Soucy to perform truly amazing aerobatics shows. When it comes to RC models, I think biplanes still have the edge in the "wow" department.

Regardless of the type of biplane you want to fly—a WW I fighter, a scale civilian, or a sport/aerobatics biplane—all the same aerodynamics principles apply. Center-of-gravity (CG) placement, wing incidence and decalage angles all contribute to how well a biplane flies. If you have never built or flown a biplane, I suggest you stick with the recommendations of the model's designer. If you want to design your own, here are a few things to remember.

Figure 1
Wing Stagger

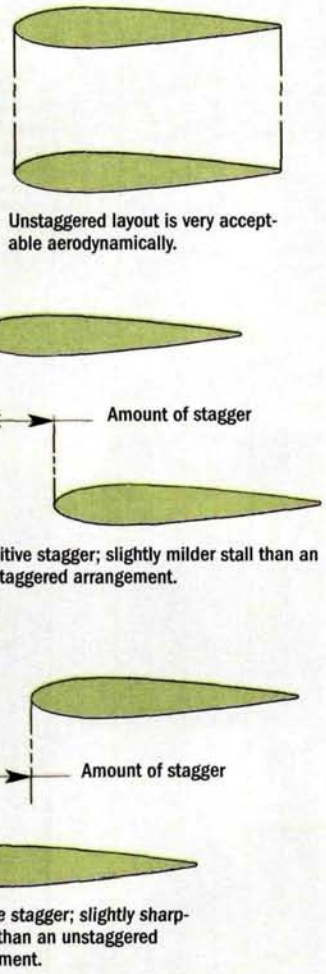
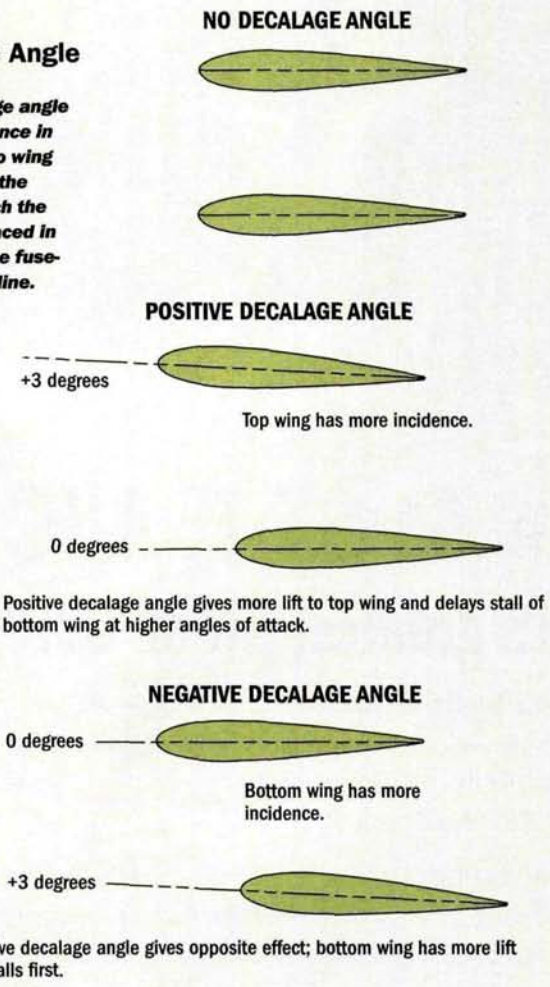


Figure 2
Decalage Angle

Wing decalage angle is the difference in the bipe's two wing incidences—the angle at which the wings are placed in relation to the fuselage's centerline.



WING STAGGER

Biplanes have three basic wing arrangements: unstaggered, positive stagger and negative stagger (see Figure 1). Many early designs, such as the Wright Flyer and the Spad, have an unstaggered arrangement in which the wings' leading edges are directly over each other. As long as the gap between the two wings is wide enough, this arrangement is very acceptable aerodynamically. The more typical Stearman, WACO and Fleet biplanes have positive stagger: the top wing is positioned forward of the bottom wing. This produces a slightly milder stall characteristic than the unstaggered arrangement. In comparison, the unusual Beechcraft Staggerwing with its negatively staggered wings has a slightly more pronounced stall break.

DECALAGE ANGLE

The term "decalage" refers to the difference in the biplane's two wing incidences—the angle at which the wings are placed relative to the fuselage's centerline (see Figure 2). A positive decalage angle gives the top wing more positive incidence than the bottom wing. Conversely, negative decalage gives the bottom wing more incidence angle than the top. A biplane with both wings set at the same incidence has no decalage angle. For general all-around good performance, most positive-stagger biplanes are set up with positive decalage. In this arrangement, the top wing generates slightly more lift than the bottom and, when stalled, causes the model's nose to drop for a natural recovery. With negative stagger, negative decalage has the same effect

BALANCING BIPES

Something that often confused me when I first started flying biplanes was how to properly balance them. People used to give me very complicated formulas and otherwise well-meaning advice to figure out where the balance point was, but there is a very simple way to get the CG right. For biplanes with straight wing panels of equal chord (see Figure 3), add the amount of wing stagger to the top wing's chord to determine the model's mean aerodynamic chord (MAC). Then simply balance the model at the 25-percent point of the MAC measured from the top wing's leading edge.

For airplanes with swept top wings, the procedure is only slightly more involved (see Figure 4). At the wing roots, measure horizontally between the top wing's leading edge and the bottom wing's trailing edge, and use this amount as the root-chord length. Do the same at the wingtips, and use that measurement as the tip-chord length. Now, treat the whole arrangement as if it were a tapered wing panel. Add the tip-chord distance to the front of the root leading edge and the back of the root trailing edge, and then add the root-chord distance to the front of the tip leading edge and the back of the tip trailing edge. Draw reference lines to form an X, as shown in the illustration; where the two

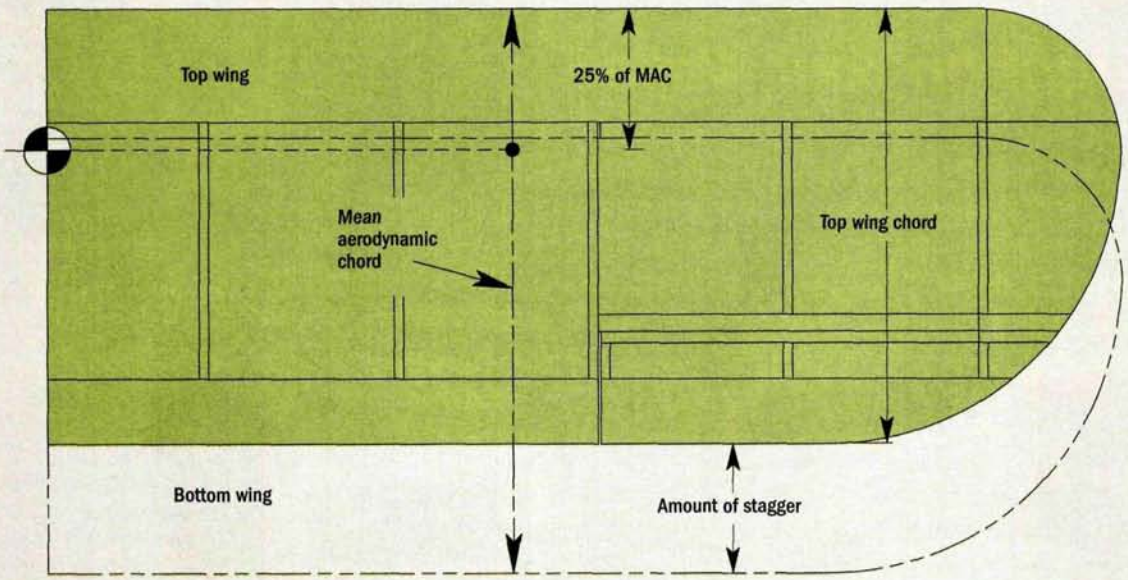


Figure 3
Biplane CG for positive stagger wings

To determine the MAC of a straight-wing, positive-stagger biplane, add the top wing chord to the amount of stagger between the two wings. The CG should then be set at 25% of the MAC. If there is no stagger, then the MAC is the chord of the upper wing.

lines intersect, draw the MAC line parallel to the wing's centerline. Now, measure back from the leading edge 25 percent of the MAC to find the balance point. This is a lot harder to explain than it is to do; just look at the illustration to see how it's done. No difficult math involved.

FLYING BIPLANES

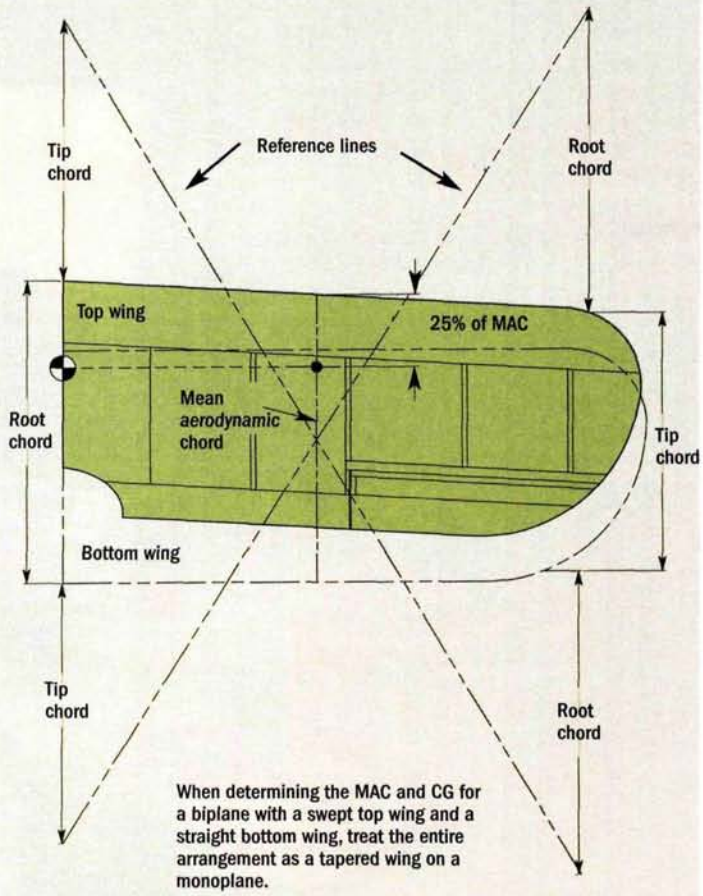
Biplanes produce more drag and require slightly more power than monoplanes. Also, because their wingspans are shorter, biplanes tend to roll more quickly. Properly set up, most biplanes require only a slight amount of up-elevator to break free of the ground during the takeoff roll and then may require slight forward stick pressure to keep the climb angle shallow. In normal cruise, use about ½ throttle, and always use rudder to coordinate your turns. On occasion, I have found it beneficial to first use rudder and then add aileron to make turns smoothly; it all depends on the model you are flying. On final approaches and landings, use a little more power than you are used to; control the model's airspeed with small changes in pitch (elevator) and its descent with small changes in throttle setting. If you play everything just right, you can make the most beautiful spot landings with biplanes with only very small adjustments. Just remember to keep the nose pointing downward slightly to maintain adequate airspeed. As with any other big-bird model, if balanced and powered properly, biplanes aren't any more difficult to fly than other models. You do have to build twice as many wings, but the rewards are well worth the extra effort when you see your new biplane fly for the first time.

That's it for this month; as always, if you have any big-bird questions or comments, I'd love to hear from you. You can write to me c/o Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606, or email Gerryy@airage.com. ±

***Great Planes Model Distributors Co.**, P.O. Box 9021, Champaign, IL 61826-9021; ((800) 637-7660; fax (217) 398-0008; www.greatplanes.com.*

***Top Flite;** distributed by Great Planes.*

Figure 4
Biplane CG for swept top wing



When determining the MAC and CG for a biplane with a swept top wing and a straight bottom wing, treat the entire arrangement as a tapered wing on a monoplane.

Make scale rigging

Easy non-functional flying wires

by Nick Ziroli Sr.

It isn't difficult to make scale rigging and flying wires for biplanes. The method described here is for non-structural use and is only to improve the model's appearance. Once installed, the rigging takes just a few minutes to assemble or disassemble and is very realistic looking.

Nick Ziroli Sr. has been flying his Stearman PT-17 for a couple of years now, and the model's rigging wires look as good as new. These non-functional flying wires add a lot to the scale appearance of Nick's model. This article shows you how he made them.

BOY SCOUTS TO THE RESCUE

If you were a Boy Scout, you are probably familiar with the rigging material that I used; it's called "plastic lace" and is available at most craft stores. It is the same flat, plastic material as we wove into lanyards, key chains and other novelty items when earning our Scouting badges (I've also heard the material referred to as "boondoggle" and "gimp"). Modelers will appreciate its realistic streamlined shape, low cost and the many colors it comes in. I used silver and bright silver chrome to make my rigging.

The material is about 3/32 inch wide and about 1/32 inch thick—just about the right size for most 1/6- to 1/4-scale models. I used it on my 22.5-percent-scale, 87-inch-span Stearman PT-17, and it looks great.

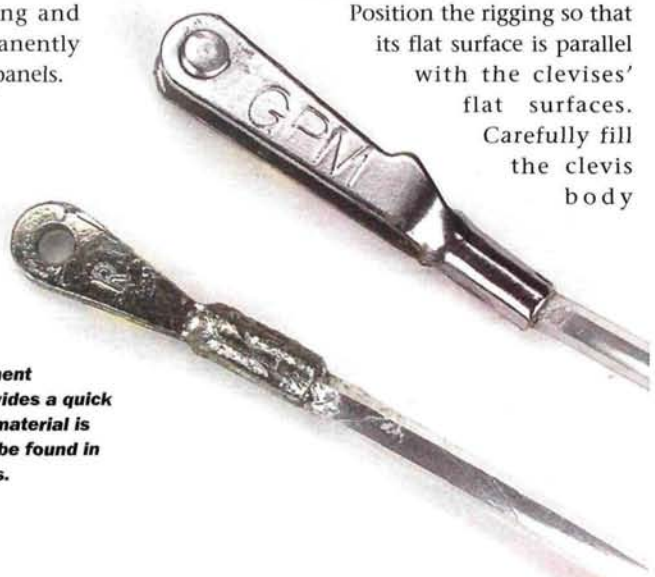
HARDWARE

For sport scale, standard 2-56 clevises make good-looking rigging connectors. Robart clevis links, however, are more realistic. These come packaged with Robart's swivel-ball control-horn sets and are secured into place with a small screw and locknut. Though they look more scale than the others, Robart clevises, with their screws and nuts, take a bit more time to assemble and disassemble. To get the realism and ease of assembly that I wanted, I used a combination of these clevis types. I put the standard ones under the top wing where they aren't easily seen and the Robart clevises on top of the bottom wing, where they are always in clear view. To take the model apart, I simply disconnect the clevises from the upper wing and leave the Robart ones permanently attached to the bottom wing panels.

MAKING RIGGING

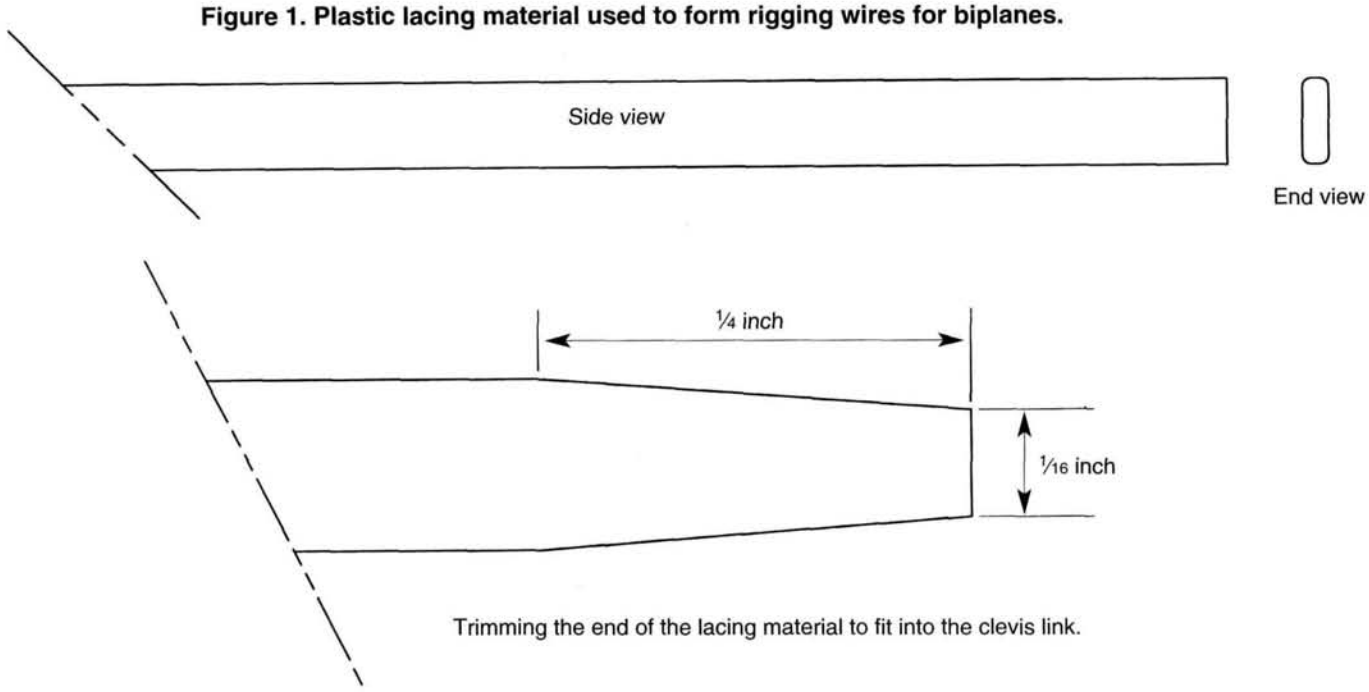
It's very simple to make any length of flying and landing wire that you want. First, cut the rigging slightly oversize and then trim the front and rear edges of one end at a slight angle—about 1/4 inch long—and leave the end about 1/16 inch wide (see Figure 1). Hold the plastic with a pair of pliers, and screw the clevis over the end (don't use solder links). The tapered end allows the material to be threaded into the link; the threads bite into the material and make the connection stronger (it may help to squeeze the end of the lace with pliers to make it a little narrower).

Position the rigging so that its flat surface is parallel with the clevises' flat surfaces. Carefully fill the clevis body



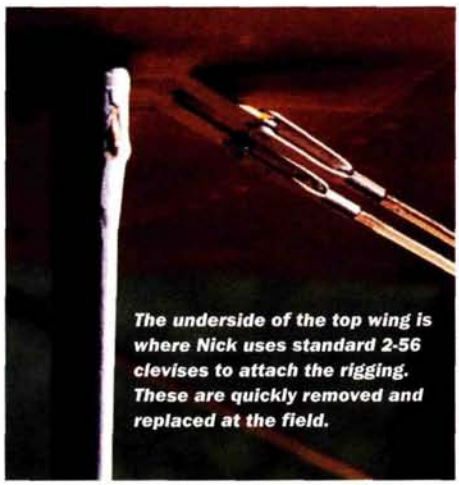
Right: the simple parts needed to make the plastic rigging wire. The wire lugs are used for permanent attachments, while the clevis provides a quick disconnect. Left: the plastic lace material is available in large spools and can be found in several colors at most craft stores.

Figure 1. Plastic lacing material used to form rigging wires for biplanes.



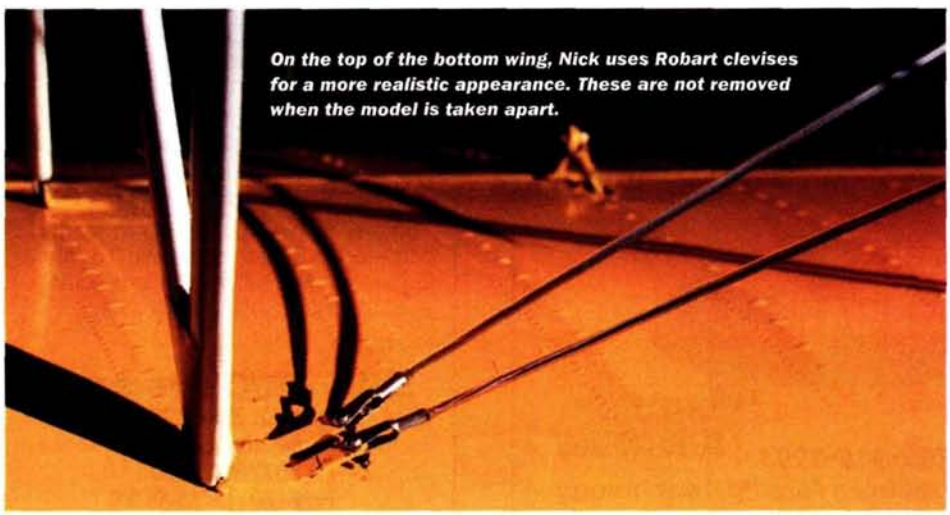
Trimming the end of the lacing material to fit into the clevis link.

with thick Zap, and be sure to fill the space on each side of the plastic lacing. Use just enough glue to avoid having any excess run out the other side. The threads and CA make a very strong bond with the plastic lacing. I have attempted to pull the lacing out of the clevis, but it only stretches. The final length of the flying wires must be determined when the rigging is in place on the model.



The underside of the top wing is where Nick uses standard 2-56 clevises to attach the rigging. These are quickly removed and replaced at the field.

Metal landing-gear straps make good attachment points for the rigging. Bend them in the middle to the proper angle and screw one end to a plywood plate in the wing, stabilizer, or fuselage side. The clevises can then be attached to the protruding tab. Attach the rigging to one of the tabs, and hold the other end to the opposite tab. The second clevis should be attached to the plastic lacing so that the final rigging length is shorter than needed. This allows you to stretch the rigging when both ends are connected. As a tightness guide, I have found that for rigging about 18 inches long, you should aim to make it ½ inch shorter. For a 24-inch rigging, make it about ¾ inch shorter. Cut the lacing so that when it's stretched, it will fit inside the body of the second clevis.



On the top of the bottom wing, Nick uses Robart clevises for a more realistic appearance. These are not removed when the model is taken apart.

PERMANENT RIGGING

Crimp-on electrical wiring lugs can also be used for permanent rigging such as that on a stabilizer or on cabane struts. RadioShack sells many lugs that are ideal for model use. The catalog number for the Solderless Ring Tongue set is 64-3030A. Use the 22-gauge wire lugs for no. 4 or no. 6 screw holes. Big home-improvement stores also carry these lugs. They aren't threaded, so the lacing must be forced into the body and glued securely. Wire lugs are smaller than the clevis links and look better for permanent installations. Just be sure to include a hard point where they're attached to the model so you can screw them securely into place.

The next time you think your biplane needs a little something extra, add some rigging wires. I've built a number of models that went without rigging because it was just too much trouble. This method makes fabrication as well as field assembly and disassembly fast and easy. Give it a try; you'll love the results. ✈

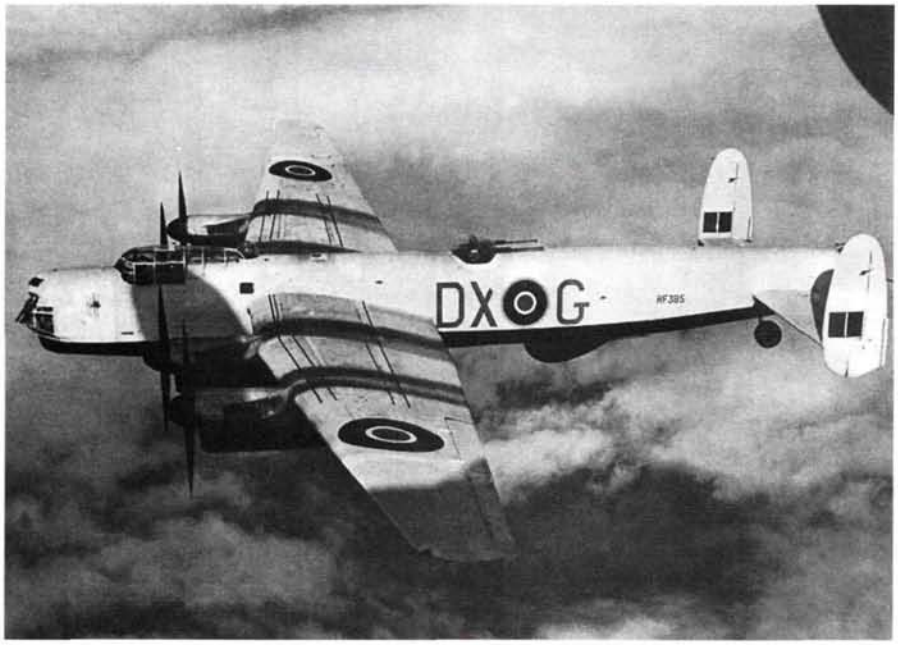
***Pacer Technology**, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730; (800) 538-3091; fax (909) 987-0497; www.pacertechnology.com.*

***Robart Mfg.**, P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174; (630) 584-7616; fax (630) 584-3712; www.robart.com.*

NAME THAT PLANE

Can you identify this aircraft?

SEND YOUR ANSWER to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.



The winner will be chosen, four weeks following publication, from correct answers received (delivered by U.S. mail) and will be awarded a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will be given a free, one-year subscription extension.

Congratulations to Robert Craig Robinson of West Hartford, CT, who correctly identified February's mystery plane as an Airspeed Oxford. Originally designed as military counterparts to the Envoy, the first production Oxfords entered the Central Flying School in November 1937 as the Royal Air Force's first twin-engine, cantilever, low-wing trainers. A total of 8,500 Oxfords were eventually produced and served in training, communications and ambulance roles. There were five versions of the Oxford; different versions were used as pilot, radio-operator and navigator trainers, as well as a weapons trainer. The "Ox-box," as it became known, also saw service with the air forces of Australia, Canada, New Zealand, South Africa, Southern Rhodesia and Portugal. Powered by two Armstrong Siddeley Cheetah X radials, the Oxford shown here had a cruising range of 960 miles and could reach a maximum airspeed of 183mph. ✈

CLASSIFIEDS

RATES: non-commercial—25 cents per word (no commercial ads of any kind accepted at this rate); commercial—50 cents per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. **All ads must be paid for in advance.** To run your ad for more than one month, multiply your payment by the number of months you want it to run. Deadline: the 10th day of the month, 3 months in advance, e.g., *January 10 for the April issue.* We don't furnish box numbers, and it isn't our policy to send tear sheets. Please make all checks payable to: **AIR AGE INC. SEND AD AND PAYMENT TO: CLASSIFIED ADS, *Model Airplane News*, 100 E. Ridge, Ridgefield, CT 06877-4606 USA, orcall (203) 431-9000.**

BUSINESS

MODEL AIRPLANE NEWS 1952-1980; "Air Trails" 1937-1952, "Young Men" 1952-1956, "American Modeler" 1957-1967, "American Aircraft Modeler" 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, BC, Canada V0R1L1. [4/02]

GIANT-SCALE COCKPIT KITS. ½-scale P51, P40, F8F, 19% P47. Viking Cockpits, 13738 Destino Pl., Cerritos, CA 90703; (562) 926-4180; email brucevike@aol.com. [6/02]

BOEING F4 AND P12. Bristol, Camel, Fleet Finch, Fokker D7, Jenny, Nieuport, Po2, SE5, Spad and Waco. Full-size patterns for all, $19. Ages 2-7. Includes instructions and postage. Bill of materials totals $38. Pedalplanes.com, copyright 1966, all rights reserved. Ages 4-14. All above Fokker DR1. Write to: 20615 91 Ave. E., Graham, WA 98338; Toyplane@qwest.net. [4/02]

NEW: ENGINE SERVICE AVAILABLE IN NORTHEAST. Save on shipping time and cost! Call, fax, or email for free estimate. All makes and sizes, 2- or 4-stroke, gas or glow, plane, heli, boat and car. Over 20 years experience. Bill Jensen, B.J.'s Model Engine Service, 36 Macintosh Dr., Oxford, CT 06478; (203) 888-4488; fax (203) 888-3255; email:WbillJensen@cs.com. [3/02]

WARPLANE WINDVANE PLANS! Build amazing scale windvanes! Details: Windm, 520 Hooper Rd., 153, Endwell, NY 13760-1960;www.windm.com. [5/02]

MAKE YOUR OWN ROCKET MOTORS!!! Homemade solid and composite fuels power RC gliders, model rockets, etc. Smoke tracers for RC planes and choppers, electric igniters, cannon fuse "chemicals," lab acids, glassware, "how to" books, videos and rocket motor kits. HUGE catalog, $2. Pyrotek, P.O. Box 300, Sweet Valley, PA 18656; (570) 256-3087; www.pyrotek.org. [5/02]

RYOBI CONVERSIONS. We are the oldest, the best and least expensive. For complete engines, conversion kits, or our 360-degree muffler, we have all your conversion needs. For free conversion instructions and catalog, send SASE to Jag Engines, 16073 Muscatel, Hesperia, CA 92345; (760) 244-7270, or see our website at http://www.jagengines. com. [6/02]

BOB'S AIRCRAFT DOCUMENTATION 2002. World's largest commercial collection of aircraft photos (400,000) and 3-view line drawings (35,000). 256-page catalog, $8 (Canada, Mexico, Alaska, Hawaii, Puerto Rico—$10; foreign, $18; includes postage). 3114 Yukon Ave., Costa Mesa, CA 92626 USA; (714) 979-8058. [12/02]

FOR SALE: Scale plans for a 57-in.-wingspan Westland Lysander. Must structurally build it to suit your needs. For use with high-powered or heavy engines. Plans come in 29 sections. Approximately 12x3 feet. Price: $120 in U.S. funds only. Make checks payable and mail to: Lee R.T. Frick, P.O. Box 2201, Murrells Inlet, SC 29576. Please allow 30 to 60 days for delivery. [6/02]

ALUMINUM CAN PLANS. Build airplanes, vehicles, locomotives and construction equipment. Free list. Tesscar, Box 333A, Scappoose, OR 97056, or www.tesscar-aluminum-craft.com. [9/02]

SPECIALIZED AND CUSTOM MACHINING: need that special part fixed or replaced, but it can't be purchased? "We can do it." Kmfontaf@adelphia.net. (724) 468-8152, (724) 468-0478. [5/02]

ART WORK: your favorite plane reproduced in embossed aluminum by hand (12x7 in.). Send us the plane designation—for example: P51 Mustang, Spitfire, Stuka, B29, ECC; we will propose two views of it for you to choose from. Or, simply send a photograph. Price: $38 plus $24 UPS shipping. Introductory offer: two different planes for $88, UPS shipping included! Larger works; many other themes. Ask for catalog. Email abrahamchv@yahoo.com.mx. All prices in U.S. dollars. [4/02]

NOW GET ENGINE SERVICE ESTIMATES ONLINE! Go to www.starcomposites.com/BJMModelEngines/, or contact us directly for a free estimate. We service all makes, models, sizes and strokes, gas or glow, plane or heli, boat and car. Experienced. Custom service. Your parts, out-of-production engines, crashed—all OK. Bill Jensen, BJ's Model Engine Service, 36 MacIntosh Dr., Oxford, CT 06478; email wbilljensen@acs.com; (203) 888-4488; fax (203) 888-3255. [12/02]

OTT-LITE TRUE COLOR LAMPS FOR YOUR SHOP! Bright, glare-free, perfect for color matching, CRI = 95. Bring full spectrum daylight illumination inside! Discount prices! (800) 742-4289; www.lumenlight. com. [4/02]

GAS ENGINE CONVERSIONS, KITS AND PARTS: Homelite, Weedeater, Ryobi, McCulloch, Honda. Information, $5. Visa/MC. Carr Precision, 6040 N. Cutter Cir., #303, Portland, OR 97217; phone/fax (503) 735-9980; www.carrprecision.com; email carrprecision@worldnet.att.net. [4/02]

MODEL AIRPLANE SCHOOL: at Hobbies Aloft R/C Flight School, you will experience more than 100 hands-on landings per day of training until you solo—guaranteed! Ray Smith will be your personal trainer, and using "kinesthetic instruction" (no buddy-boxes), he will guide you down to each landing until you can execute the landing sequence all by yourself. Typical students require 4 to 6 days of training to solo, and then their RC flying fun really begins! We fly year-round on the beautiful California coast near Monterey. Call toll-free, (888) 700-4421 to make a reservation, and please visit our website: www.hobbiesaloft.com. [6/02]

PLANS: scale RC sailplanes. Powered, rubber, oldtimer, nostalgia. 130-page illustrated catalog, $2. Cirrus Aviation, Box 1375, Nanton, AB T0L 1R0 Canada; www .telusplanet.net/public/h_bvolk/. [5/02]

HOBBYIST

MAGAZINE BACK ISSUES: *Model Airplane News, RCM, FM.* Model and full-scale titles, 1930-1999. Send SASE for list: Carolyn Gierke, 1276 Ransom, Lancaster, NY 14086. [5/02]

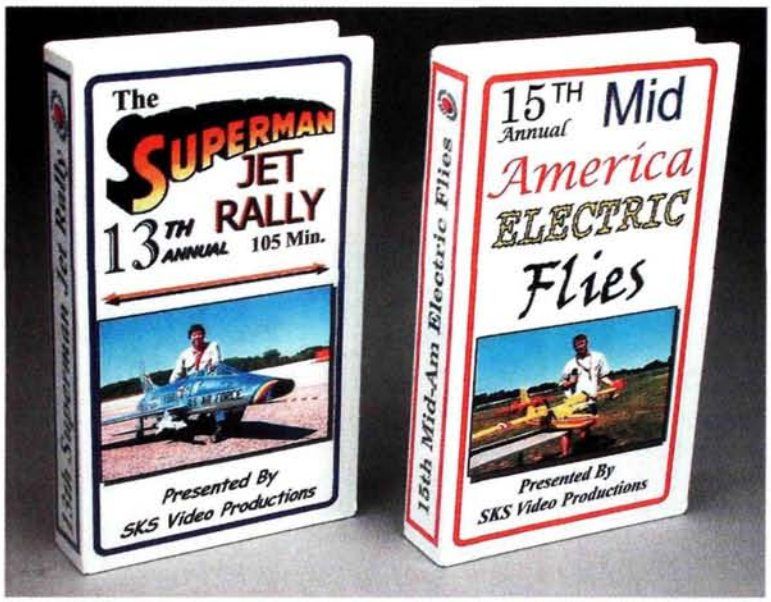
USED ENGINES WANTED: pre-1970 preferred. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [11/02]

WANTED: unbuilt Sterling kits, E-6 Piper Super Cruiser, FS-1 Piper Tri-Pacer, FS-8 Piper Super Cruiser. Dana E. Anderson, 35997 467 Ave., St. Edward, NE 68660.[5/02]

EVENTS

"T.O.C." OF MARYLAND—2002 FLYING COMPETITION. Fri., May 31 to Sun., June 2, 2002. IMAC-style event w/emphasis on freestyle aerobatics. Relaxed open flying Friday; banquet on Saturday evening; $$$ prizes; raffles; food. Contact Art Vail, (410) 247-4281; email artvail@erols.com. [6/02]

AT *MODEL AIRPLANE NEWS*, we not only tell you what's new, but we also try it out first so we can bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."



SKS VIDEO PRODUCTIONS

13th Superman Jet Rally Video
15th Mid-America Electric Flies Video

Latest event coverage

Videotapes are a great way to see what's going on in the RC world. The growing popularity of jet models was evident at the 13th Annual Superman Jet Rally with more than 180 registered pilots. This video showcases the wide range of aircraft that flew, including Bob Violett's new F-100 Super Saber, Jerry Keller's Hawker Hunter, Dan Topham's F-105 Thunderchief and many others. The video also highlights Didi Kramer's turbine-powered Cobra helicopter and provides a close-up look at the new JG-100 Turbine.

For you electrics enthusiasts, the 15th Annual Mid-America Electric Fly attracted approximately 100 pilots with aircraft ranging from the simple to the complex. This video has something for everyone, including Don Belfort's 6-engine B-36 bomber, a Westland Whirlwind by prolific designer and builder Mark Rittinger and Mark Wolf's He-219.

Each video runs just over 90 minutes and costs $19.95 plus shipping. This is a great way to see the diversity of the RC hobby in the comfort of your own home. —*Rick Bell*

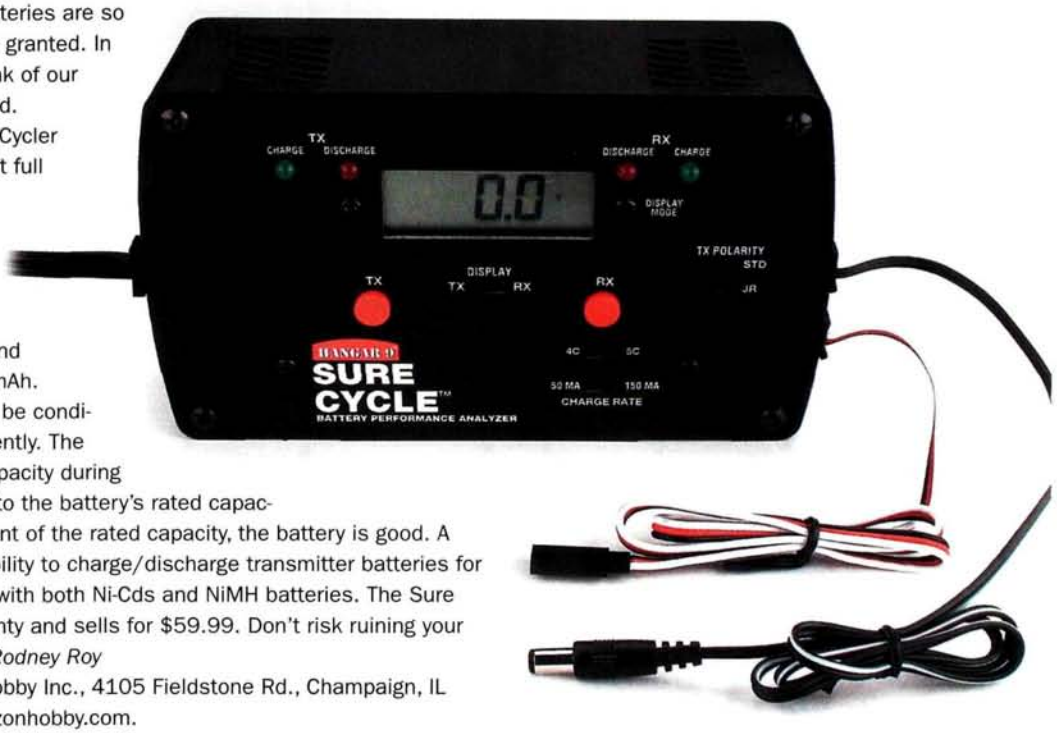
SKS Video Productions, 85 Pine Rd., Abbottstown, PA 17301; (800) 988-6488; www.sksvideo.com.

HANGAR 9

Sure Cycle Battery Cycler

Is your battery safe to use?

Today's radio systems and their batteries are so reliable that we often take them for granted. In reality, batteries are the weakest link of our systems and yet are often neglected. Hangar 9's new Sure Cycle Battery Cycler can help you maintain your packs at full capacity. This easy-to-use charger/cycler will discharge, charge, condition and analyze your transmitter or receiver battery pack at a preset discharge rate of 400mAh and then charge it at either 50- or 150mAh. Transmitter and receiver packs can be conditioned simultaneously or independently. The unit measures actual full-charge capacity during discharge, which you can compare to the battery's rated capacity; if it measures at least 70 percent of the rated capacity, the battery is good. A neat feature of the charger is its ability to charge/discharge transmitter batteries for most radio types and that it works with both Ni-Cds and NiMH batteries. The Sure Cycler comes with a two-year warranty and sells for $59.99. Don't risk ruining your flying fun—cycle your batteries! —*Rodney Roy*



Hangar 9; distributed by Horizon Hobby Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; www.horizonhobby.com.

Advertisers

MODEL AIRPLANE NEWS (ISSN 0026-7295, USPS 533-470) is published monthly by Air Age Inc., 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Periodical postage permit paid at Ridgefield, CT, and additional mailing offices.

SUBSCRIPTIONS. U.S. and Canada, call (800) 827-0323; elsewhere, call (815) 734-1116. Or set your Web browser to www.airage.com/subscribe.html. **U.S.**: $34.95 (one year), $55.95 (two years). **Canada**: $49.95 (one year), $87.95 (two years), inc. GST, reg. no. 13075 4872 RT. **Elsewhere**: $48.95 (one year), $83.95 (two years). Prepayment required; Visa, MC and AmEx accepted.

EDITORIAL. Send correspondence to Editors, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Email: man@airage.com. We welcome all editorial submissions, but assume no responsibility for loss/damage of unsolicited material. To authors, photographers and people featured in this magazine: all materials published in *Model Airplane News* become the exclusive property of Air Age Inc., unless prior arrangement is made in writing with the Publisher.

ADVERTISING. Send advertising materials to Advertising Dept., *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; phone (203) 431-9000; fax (203) 431-3000.

CHANGE OF ADDRESS. To make sure you don't miss any issues, send your new address to *Model Airplane News*, P.O. Box 428, Mount Morris, IL 61054 USA, six weeks before you move. Please include the address label from a recent issue, or print the information exactly as shown on the label. The Post Office will not forward copies unless you provide extra postage.

POSTMASTER. Please send Form 3579 to *Model Airplane News*, P.O. Box 428, Mount Morris, IL 61054 USA.

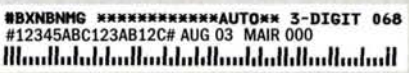
MODEL Airplane NEWS

Customer Service

Thank you for joining the Air Age family of publications where you can explore the exciting worlds of radio control and aviation.

These tips will help you get the most out of your subscription:

How to read your label:



Your account number is 12345ABC123AB12C.
Your expiration date issue is August 2003.

How and when to tell us of an address change

Address changes should be requested before you move. Our labels are printed ahead of time, so please allow 4-6 weeks for the change to take effect. Please include a copy of your current label. Send all address changes to:

Model Airplane News
P.O. Box 428
Mount Morris, IL 61054

You may also contact us via email at MAIR@kable.com, or fax (815) 734-1223.

Our cancellation policy

All cancellations must be requested in writing. You may send in your request via mail, email, or fax. You will be sent a refund for all unserved issues.

Our renewal policy

Renewal notices are sent six months prior to your expiration date (see label above). You may renew your subscription via mail by sending in your renewal invoice with payment. For faster service, renew online at **www.modelairplanenews.com**

Effective October 2001, **the best deal will be in the first renewal notice you receive.** By renewing early and for a longer term, you create savings for us, which we pass on to you. So always check your first renewal effort for the lowest price available.

BY GARY GRESS

click trip MODELAIRPLANENEWS.COM TO SEE THIS MODEL FLY, CLICK ON THE VIDEOS LINK.

Homebuilt VTOL

SPECIFICATIONS

MODEL: gimbaled, tilt-prop VTOL

DESIGNER: Gary Gress

SPAN: 19.6 in. (between propeller shafts)

AIRFRAME: 1/8 and 3/16-inch-diameter carbon-fiber tube

FLYING WEIGHT: 16 oz.

RADIO USED: Hitec Feather 4-channel receiver w/two JR NES-241 sub-microservos

MOTORS USED: two SimProp Power Speed 300 6Vs w/two modified Horst 280 6:1 gearboxes and two Jeti JES110 11A or Great Planes Electrifly C-10 speed controls

PROPS: Roswell Flyer, 11.5-in.-diameter

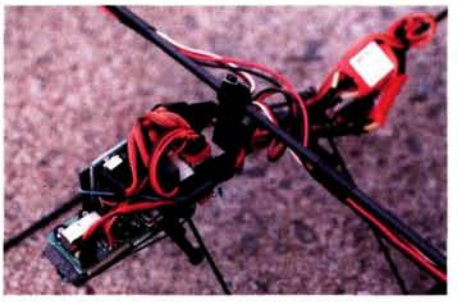
MIXERS: one WattAge fixed elevon mixer and one VeeTail adjustable elevon mixer

GYROS: three Heli-Max micro piezos with covers removed

BATTERY: 8-cell, 600mAh Ni-Cd

Vertical takeoff and landing (VTOL) aircraft have always fascinated me, so I decided to try to build a tilt-prop model. This version (patent pending) is the latest in a line of about seven or eight generations of designs, each generally lighter and simpler than the one that preceded it. But none of the previous versions was able to hover for more than a few seconds, mainly because of a lack of stability in pitch.

I finally overcame these problems and achieved a successful hover with my latest model, which uses just two airplane propellers to provide lift and ensure stability and control. I managed to eliminate helicopter-type cyclic pitch controls as well as any other devices that react with the air. This aircraft achieves pitch and yaw control in hover by tilting its propellers, and roll is controlled by varying the speed of the two motors. Driven by piezo gyros through external mixers, two sub-microservos and two electronic speed controls round out the model's equipment.



A close-up view of the micro-size radio gear that controls my aircraft.

The concept for this model was inspired by the Bell XV-15 and Bell/Boeing V-22 Osprey tilt-rotor aircraft, but I believed I could take advantage of a model's relatively small size and make it simpler. So instead of helicopter-type rotors, I decided to use conventional airplane propellers, but it took a lot of experimenting to make the plane stable and controllable in pitch.

I eventually found that by mounting the motors on gimbals (thereby allowing them to swivel sideways and tilt forward and backward around the wing tube), I could achieve unqualified pitch control of the plane via 90-degree precession. (Precession is a unique feature of gyroscopes. Remember trying to turn the axle of a spinning bicycle wheel?)

By applying a lateral or sideways moment to the gimbaled motor/gearbox, and consequently to the propeller, the assembly tilts in the desired longitudinal direction, 90 degrees from the direction of the applied moment. The reactions of the propeller assemblies on the airframe cancel each other, and pitch control is unaffected.

With this method, however, there wasn't enough stability in pitch, so I augmented it by adding a piezo gyro to the control circuit. That's all I needed to achieve stability; I finally had absolute control of the propellers.

Though the battery pack allows 2½ minutes of flight time, typical hovers last only about 30 to 45 seconds. Because low temperatures affect the gyro and battery performance, all but one of the flights has taken place in the 9x9 confines of my living room. Though the plane is stable and tends to remain over one spot, it is difficult to maintain a constant altitude of 3 to 4 feet in such a small space.

This is the extent of the testing done to date. I am now working on a new model with wings, a proper fuselage and other changes that will enable transition and cruise. Since tilt and differential thrust control are already available in hover mode, I plan to use them for control in cruise, as well. This will, I hope, eliminate the need for control surfaces and their associated servos.

Anyone who has questions about this project is welcome to email me at ggress@attcanada.ca.